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# COLLECTIVE REVIEW

## THE SURGICAL PHYSIOLOGY OF THE SYMPATHETIC NERVOUS SYSTEM WITH SPECIAL REFERENCE TO CARDIOVASCULAR DISORDERS

R. H. GOETZ, M.D., Cape Town, South Africa

ORIGINALLY performed for the relief of epilepsy, glaucoma, migraine, and exophthalmic goiter, surgery on the sympathetic nervous system and its indications have undergone considerable modification since its introduction at the end of the last century by Alexander (1889), Jonnesco (1896), and Jaboulay (1899). The credit for being the first to realize the potential value of sympathetic interruption in the treatment of vasospastic disorders goes to Jaboulay (1899). It was he who developed periarterial sympathectomy, and the operation was later popularized by his pupil, Leriche (1913). However, as a result of our better understanding of the peripheral sympathetic pathways (Kramer and Todd, 1914; Woollard and Norrish, 1934), periarterial sympathectomy has since been entirely replaced by ganglionectomy, and lately by preganglionic ramisection.

Originally, the indications for sympathectomy were few, and the operation was considered difficult to perform. It was carried out only by surgeons who had done a considerable amount of research in this field and were thus familiar with all the anatomical and physiological aspects of the subject. Within recent years, however, the indications for sympathectomy are continuously becoming more numerous and more clearly defined and the approach to the sympathetic system has been very much simplified. As a result, the operation has been added to the repertoire of most general surgeons, many of whom must be out of touch with recent scientific developments and knowledge of the recognized prerequisites for successful operation. Thus only, can it be explained that the results obtained have been extremely varied, and, in fact, diametrically opposed in well known clinics. This is best illustrated by quoting Samuels (1934): "In my experience these operations (sympathectomy and ganglionectomy) have no place whatsoever in the treatment of gangrene or in any phase of thromboangiitis obliterans," and in the latest edition of his textbook on diseases of the peripheral arteries (1940): "The magnitude of the procedure and the great operative risk as well as a fairly high mortality certainly do not justify its performance in either thromboangiitis obliterans or arteriosclerosis." This is entirely opposed to our experience and that of many other clinics. Our results have always been very gratifying, provided the operation was based on definite indications. I have, however, to state emphatically that the operation must not be carried out as a last resort and that no operation is able to revive an already gangrenous limb!

The extraperitoneal approach to the lumbar sympathetic, as described by Leriche (1926, 1933) and by Pearl (1937), and the transthoracic approach to the thoracic sympathetic as first described by Goetz and Marr (1944) have certainly reduced the magnitude of the operation, and in

From the Department of Peripheral Vascular Diseases, Groote Schuur Hospital, and the Surgical Research Department, University of Cape Town.

our series of over 300 consecutive sympathectomies[1] carried out during the last 14 years, there has been not a single operative death.

A sound knowledge of the anatomy and of the physiology of the field in question is even more essential for carrying out a successful sympathectomy than for most other operations. Yet this is made difficult by the fact that there are few short treatises presenting the subject from the surgeon's point of view, and the available charts of the sympathetic pathways do not furnish the information essential to the surgeon. We have therefore endeavored to present in this article such facts of the anatomy and applied physiology of the sympathetic nervous system as are of importance to the surgeon.

When we say *sympathetic* nervous system, we use the words in the narrow sense, i.e., we do not include the *para*sympathetic nervous system. Furthermore, we shall be dealing almost exclusively with the motor, the efferent side of the sympathetic arc, leaving the afferent or sensory part entirely out of consideration, with the exception of the afferent fibers to the heart.

## HISTORICAL

The first account of the ganglia of the sympathetic nervous system and of the splanchnic nerves was given by Galen in the second century (Sheehan, 1936), and a clear, anatomical concept of the sympathetic chain and its connections was already known to Etienne (1545), Eustachio (1552), and Willis (1664). The vascular (sympathetic) nerves, however, were not discovered until the famous experiments of Claude Bernard in 1852.

Etienne, Eustachio, and Willis all gave the sympathetic chain a cerebral origin (similar to the cranial nerves), a mistake later corrected by the French surgeon, François Pourfour du Petit in 1727, after he had ascertained that the fibers in the carotid canal were ascending instead of descending nerve filaments.

The term "sympathetic" was introduced by Winslow (1732), and Bichat (1800) was the first to correlate the sympathetic nervous system with the metabolic functions of the body. He noticed, to use his own words, that the "nerves of the ganglia are distributed everywhere to the circulatory system," and that "it is only with the arteries that they are introduced into the organ" (Sheehan 1936). It was, however, only following the discovery of nonstriated muscles by Johannes Mueller (1834), and the demonstration of their presence in arteries by Koelliker (1846) that Claude Bernard could discover the vasomotor nerves and their tonic effect on the blood vessels (1851). Only later was it recognized that the piloerectors (Schiff, 1870) and the sweat glands (Luchsinger, 1877, 1880) were also innervated by the sympathetic system.

The credit for recognizing that the sympathetic outflow originates in the thoracolumbar region only and for first postulating the existence of two antagonistic systems of nerves for the control of the involuntary musculature goes to Gaskell (1886). Langley (1898) introduced the term "autonomic nervous system" and (1893) gave us the concept of preganglionic and postganglionic neurons, the practical importance of which has only recently been fully realized.

When Langley (1901) discovered that the injection of epinephrine into the blood stream acts like sympathetic stimulation, and Elliot (1913) found that the suprarenal medulla receives a preganglionic sympathetic supply, it became clear that the suprarenal gland forms an integral part of the sympathetic nervous system. This sympathicoadrenal system has been designed to act as a single unit in case of emergency to ensure the integrated action of the body toward changes in its internal and external environment (Cannon 1920, 1928).

The sympathetic nervous system first attracted the attention of surgeons about 50 years ago.

## THE SYMPATHETIC REPRESENTATION IN THE CORTEX

Although the physiological and clinical literature contains numerous reports concerning the central control of cardiovascular functions, very little is known about the exact cortical representation of the autonomic nervous system. The evidence furnished by earlier authors, that cerebral stimulation alters the heart rate and blood pressure (Schiff 1875, Danilewski 1875), loses much of its value since Bard (1929) has demonstrated that it can be "accounted for on the basis of spread of strong, stimulating currents to subcortical regions," resulting in an unphysiological discharge. A similar objection holds good for the value of such observations as that by Zenner and Kramer (1909) who reported disappearance of the pulse from the right wrist while attempting to remove a meningioma apparently in the left frontoparietal region.

Recent investigations, not subject to such criticism, have shown that there are apparently no separate cortical areas for sympathetic and parasympathetic reactions. In the cat, dog, and monkey the autonomic system is affected as a whole from one area of the cortex, and the question

[1]This figure does not include the patients who have undergone transdiaphragmatic splanchnicectomy for hypertension.

whether we get a sympathetic or parasympathetic response depends entirely upon the physiological state of the animal at the time of stimulation (Crouch and Thompson 1939). Watts and Fulton (1934) could show in monkeys that stimulation of the premotor area produced cardiovascular effects as well as increase in intestinal peristalsis. On the other hand, excessive sympathetic activity such as panting, increase in heart rate, increased production of adrenaline, loss of bladder control, gastric hypomotility, and intestinal stasis followed by intussusception, have been described following the bilateral extirpation of the premotor area (Watts and Fulton, 1934; Fulton *et al.*, 1934; Kennard 1945). Removal of the premotor area in monkeys also paralyzes the mechanism for reflex vasodilatation in the corresponding limb. Such experimental animals, when placed in a warm atmosphere, will exhibit normal reflex vasodilatation in all extremities except the affected one, which remains cool because vasodilatation does not take place. From experiments in cats, monkeys, and the chimpanzee, Hoff and Green (1936) and Green and Hoff (1937) concluded that there is a "mechanism by which the cortex can influence the state of the cardiovascular system," and the distribution of the blood to various regions of the body. "Through this mechanism the cortex may bring about a finer adjustment of the activity of the heart and circulation in accordance with the exigencies of the external environment and the immediate activities of the skeletal musculature." Excitation of the motor cortex results in a redistribution of blood, decreasing the supply of the abdominal viscera but increasing that to those parts which would be made active by the simultaneous excitation of the motor efferent pathways from the same areas of the cortex.

Although caution has to be observed when applying experimental findings in laboratory animals to man, nevertheless, evidence is accumulating that in man, too, the motor area of the frontal lobe is sympathicomotor and exerts a definite influence on the cardiovascular system via the lower autonomic centers. Emotional disturbances and mental strain cause a decrease in the peripheral blood flow, which is dependent upon the integrity of the sympathetic pathways (Goetz 1943, 1946). Persons have been observed who seemed to have *voluntary* control over their sympathetic functions (Clymer 1870, Maxwell 1902). Lindsley and Sassman (1938) reported on one such patient who was able to produce voluntary piloerection, associated with an increase in heart rate, depth of respiration, and blood pressure, as well as dilatation of the pupils. Simultaneous records of electrical potentials from the premotor and an independent region showed characteristic changes over the premotor area only during the period of peripheral autonomic discharge. The authors interpret this as evidence of autonomic representation in the premotor area of the cortex in man.

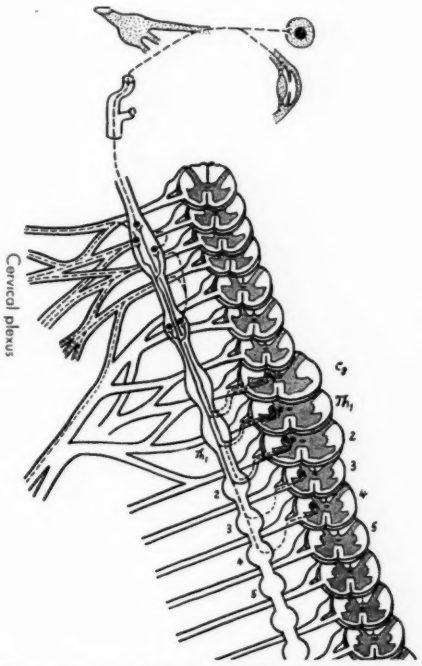


Fig. 1. Diagram of sympathetic pathways to structures of the skin of the head and neck and oculopupillary apparatus, with special reference to preganglionic pathways. The uninterrupted preganglionic fibers are constant pathways; the interrupted ones are not present in all cases.

Just as severance of somatic cortical control results in the removal of inhibitions, so does the liberation of the hypothalamic nuclei from their cerebral connections result in an increase in vasomotor, pilomotor, and sudomotor activity. Removal of the cortex in cats leads to spontaneous outbursts of motor activity, resembling responses to rage and fear, for which the term "sham rage" has been suggested by Cannon and Britton. Head and Holmes (1911) originally assumed that loss of cortical inhibition was the underlying lesion in the thalamic syndrome. However, this interpretation has been questioned (Lashley, 1938). Symptoms similar to sham rage have recently been described by Sjöquist (1941) and Wortis and Maurer (1942) in patients with epileptic seizures and fol-

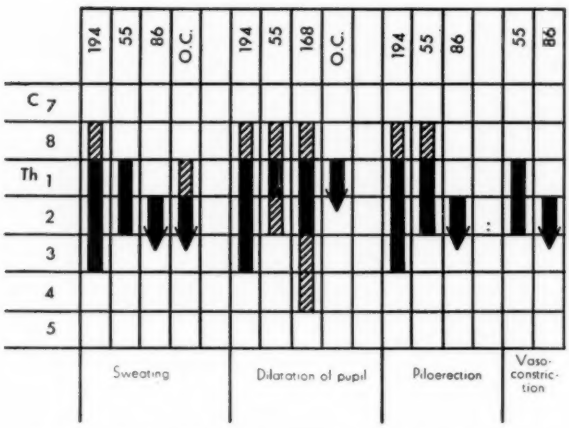


Fig. 2. Chart demonstrating segmental distribution of sympathetic outflow of fibers dilating pupil, sweat fibers, piloerector, and vasoconstrictor fibers to the structures of the neck and the head, according to various authors. *Black*—outflow present in all cases. *Shaded*—outflow present in some cases. Numbers across top of chart refer to the references of the various authors. O.C.—own cases.

lowing destruction of the cortical centers from carbon monoxide poisoning and insulin hypoglycemia. Similarly, Chevalier (1867), Eulenburg and Landois (1876), and Gowers (1888) had already noted vasomotor disturbances in cases of hemiplegia, and numerous authors have since clearly described differences between the normal and paralyzed extremity in color, skin temperature, blood pressure, sweating, and pilomotor reactions due to interruption of inhibitory fibers connecting the cortex to the vasomotor centers in the hypothalamus and the medulla (Bastian, 1886; Rossolimo, 1895; Régnard, 1913; Danielopolu *et al.*, 1926, 1931; Brickner, 1930; Olsen, 1933; Minkofski, 1933; Popper, 1933; and Uprus *et al.*, 1935). More recently, Pilcher, Wyatt, and Carney (1941) demonstrated unilateral sympathetic overactivity following blocking of the left middle cerebral artery by a large embolus. They, too, interpreted this as a release phenomenon of cortical inhibitions.

### THE HYPOTHALAMIC CONTROL OF THE SYMPATHETIC

There is a vast literature dealing with evidence of sympathetic representation within the hypothalamus and the wall of the third ventricle. Stimulation of the posterior nuclei in animals results in widespread sympathetic activity with all its characteristic responses, such as: rise in blood pressure and heart rate, pupillary dilatation, retraction of nictitating membrane, widening of the palpebral fissure, erection of hair, sweating, abolition of gastrointestinal peristalsis, contraction of the bladder, and emotional excitement (Karplus and Kreidl, 1909, 1918, 1928; Ranson and Magoun, 1933; Kabat, Magoun, and Ranson, 1935; Kabat, Anson, Magoun, and Ranson 1935; Stavraky, 1936; Ectors *et al.*; 1938; Hare and Geohegan, 1939; Walker, 1940; and Pitts *et al.*, 1941). Houssay and Molinelli (1925) and Magoun *et al.* (1937) have demonstrated that there is secretion of adrenaline as well. All these cardiovascular responses are independent of descending pathways from the cerebral cortex (Morrison and Rioch, 1937; Magoun 1938) and are not influenced by the extirpation of the hypophysis and the adrenals (Karplus and Kreidl, 1927; Stavraky 1936). They are, however, promptly abolished by resection of the thoracic sympathetic chain and the injection of a sympathetic paralyzant, such as ergotamine tartrate (Jaegher and Bogaert, 1935). They are, therefore, the result of stimulation of a projection system taking its origin within the hypothalamus.

Further evidence of hypothalamic control of cardiovascular functions was furnished by Beattie, Brow, and Long (1930), who produced ventricular extra systoles by stimulating the posterior part of the lateral wall of the third ventricle. This was corroborated by Kabat *et al.* (1934) and by Van Bogaert (1935), who showed that the extra systoles were not affected by section of the vagi but

Fig. 3.

Fig. 4.

Fig. 3. Sweating test in a patient after cauterization of left second thoracic ganglion. Note absence of sweating of left half of face, neck, and upper thorax, as well as absence of Horner's syndrome.
Fig. 4. Same patient as in Figure 3, posterior aspect.

disappeared after extirpation of the stellate ganglion. The phenomenon is, therefore, a true sympathetic response.

A vasoconstrictor center in the caudal, and a vasodilator center in the oral, part of the hypothalamus has been postulated by Beattie (1932). By recording the discharges from the preganglionic neurons to the cervical sympathetic during stimulation of the hypothalamus, Bronk and Pitts could establish that the hypothalamus is not directly connected to the spinal sympathetic motor neurons but that the medullary sympathetic centers are interposed and may actually buffer the effect of hypothalamic stimulation.

The evidence which is accumulating concerning hypothalamic control in man seems to agree well with these findings in animals. White (1940 [200]) found, during operation on 5 conscious patients, that electrical stimulation of the region of the paraventricular nucleus of the hypothalamus produced abrupt acceleration of the heart rate (up to 160 in one patient) accompanied by a moderate rise in the blood pressure. Similarly, stimulation of the anterior hypothalamus in the region of the preoptic nucleus caused bradycardia. Grinker and Serota (1938), on transphenoidal stimulation of the hypothalamic region, could demonstrate acceleration of the heart rate and respiration, increase in vasomotor tone, rise in the blood pressure, dilatation of the pupils, sweating, and contraction of the bladder.

In addition to these direct observations on the human hypothalamus, there are numerous clinical observations which point in the same direction. Tumors and other lesions which compress or destroy the walls of the third ventricle frequently cause disturbances of autonomic functions. One of the patients with a hypothalamic tumor, observed by Peet and Kahn (1936), developed, amongst other symptoms, severe vasoconstriction with cyanosis and sweating of the extremities simulating Raynaud's syndrome. A patient observed by Penfield (1929), who had a tumor of the choroid plexus in the third ventricle, had attacks of what Penfield called "diencephalic autonomic epilepsy," i.e., attacks of cutaneous vasodilatation of the face and arms, salivation, profuse sweating, pilomotor activity, dilatation of the pupils, increase in the heart rate, spasm of the sphincters, and rise in the blood pressure. A similar symptomatology was later reported by McLean (1934) in a case of tumor in the wall of the third ventricle. Sjöquist (1941) observed this syndrome with acute obstruction of the cerebrospinal circulation and Page (1935) reported on 11 patients with severe, essential hypertension simulating diencephalic stimulation.

Sjöquist is of the opinion that Penfield's diencephalic autonomic epilepsy is the result of an acute distention of the third ventricle which produces stimulation of the autonomic centers lying within its wall.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 5. Sweating test following cauterization of the left second thoracic ganglion. Note that face and neck are still sweating and that therefore there must be an outflow from $Th_1$ in this patient.

Fig. 6. Same patient as in Figure 5. Note complete absence of sweating in the left arm. No loss of sweating over the anterior aspect of the chest and in the face. No Horner's syndrome.

Fig. 7. Same patient as in Figures 5 and 6 following bilateral removal of the second thoracic ganglion. Note complete symmetry of loss of sweating in the dorsal aspect indicating that pattern is characteristic in this patient.

Summarizing the available evidence of hypothalamic control of sympathetic function, we can say that it points clearly to the presence of two distinct mechanisms, one in the posterior portion producing a co-ordinated response of numerous *sympathetic* reflexes, and the other in the anterior portion producing a similar co-ordinated response of *parasympathetic* outflow (Cushing, 1932; Beattie, 1932). Each of these seems to be directed toward the maintenance of a constant internal environment. The cortex, however, exerts a controlling (inhibitory) influence upon these mechanisms (*vide* p. 419). In addition, we must not lose sight of the fact that the hypothalamus, and thus the sympathetic nervous system, through its influence upon the pituitary body, is working hand in glove with the entire endocrine system and thus takes part in the control of the latter.

### THE SYMPATHETIC CENTERS IN THE MEDULLA

Following the discovery of the vasomotor nerves by Claude Bernard, workers in Ludwig's laboratory were able to demonstrate that these vasomotor nerves were under the influence of higher centers in the medulla (Owsjannikow, 1871; Dittmar 1873). They found that stimulation of the central end of the sciatic nerve resulted in a rise in blood pressure, even after all the brain above the medulla had been removed. More recently, Ranson (1916) and Ranson and Billingsley (1916), exploring the floor of the fourth ventricle with stimulating electrodes, identified a vasoconstrictor and a vasodilator center, as well as an area which may correspond to what Porter (1915) had termed the "vasotonic" (in contrast to the vasoreflex) center. These findings of Ranson and his coworkers were challenged by Scott (1925), but were confirmed recently in carefully controlled experiments by Alexander (1946). He could produce a reduction in the blood pressure and cardioaccelerator tone by removing the portion of the medulla located as the pressor center, i.e., in the lateral reticular formation of the rostral two-thirds of the medulla. He also demonstrated a depressor center which includes the greater part of the medial reticular formation in the caudal half of the medulla, and demonstrated once more that the pressor reflex which is produced by stimulation of the sciatic nerve depends upon the integration of the bulbar centers.

Evidence of these centers in man is still scarce and unconvincing. Starling (1925) first suggested that persistent hypertension may be the result of local asphyxia in the medulla. Various other authors (Nordmann and Mueller, 1932; Salus, 1932; Raab, 1934) have demonstrated changes in the cytology of the medulla in neurological patients who prior to death suffered from rising blood pressure which was *not* due to cardiovascular or renal pathology. They believe that these changes are of considerable significance with regard to the pathogenesis of hypertension.

Today it can be regarded as certain that in man there is bulbar representation of sweating, erection of hair, and dilatation of the pupils, and that a well localized bulbar area controls the sympathetic outflow to the entire vascular tree, i.e., arteries and arterioles as well as the veins, including the spleen. Its tonic activity may be increased or decreased by afferent nerve impulses or by variations in its blood supply, as well as by changes in the carbon dioxide tension (Raab, 1929). There is, in addition, evidence that centers controlling the cardiac activity are in close relation to these centers of vasomotor activity. The proximity of the vasomotor center to the respiratory center has long been established and, indeed, respiratory fluctuations are often imposed upon the stream of sympathetic vasomotor impulses, which can easily be demonstrated in plethysmographic records of the peripheral blood flow (Goetz, 1943, 1946).

### THE SPINAL CENTERS AND THE THORACOLUMBAR OUTFLOW OF THE SYMPATHETIC

Surgeons are usually more familiar with the centers of sympathetic activity situated in the spinal cord than with the higher supraspinal centers. From the higher centers, vasomotor, sudomotor, and pilomotor fibers descend along the extrapyramidal tracts in the posterior longitudinal fasciculus and the vestibulospinal tracts into the anterolateral columns of the spinal cord. There they establish synapsis with the ganglion cells in the lateral horns constituting the spinal sympathetic motor centers. The axons of these ganglia in the lateral horn are medullated and proceed to the corresponding sympathetic paravertebral ganglia via the anterior roots and the rami communicantes to synapse with ganglion cells in the paravertebral ganglia. These white (medullated) fibers are known as preganglionic fibers. The axons of the ganglion cells in the paravertebral ganglia (unmedullated, hence gray fibers) reach the effector organs, either by joining the spinal nerves as in the somatic regions, or by joining the blood vessels, as in the visceral (splanchnic) areas.

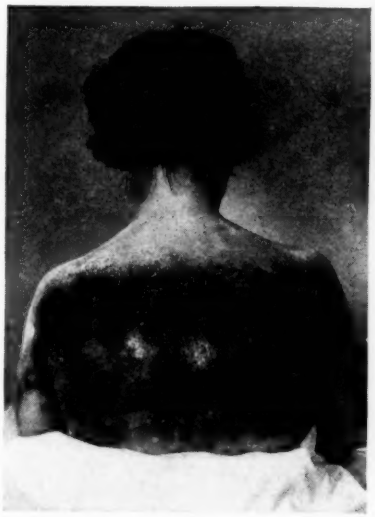

Fig. 8. Dorsal aspect of same patient as in Figures 3 and 4, but following bilateral removal of the second thoracic ganglion.

It is important to realize that in man the sympathetic centers in the spinal cord, i.e., the lateral horn, extend only from $Th_1$ to $L_2$ (Harman, 1898; Pick and Sheehan, 1946)—hence the term "thoracolumbar" division of the sympathetic. The paravertebral sympathetic ganglia, on the other hand, extend right down to the coccygeal region and up into the neck where, through fusion, there are only three instead of eight cervical ganglia. They are the inferior cervical ganglion, being the fused seventh and eighth cervical ganglia, the middle cervical ganglion, being a fusion of the fifth and sixth, and the superior cervical ganglion, representing the upper four cervical ganglia. There is, therefore, no sympathetic outflow through the anterior roots in the cervical region, nor in the lumbar and sacral region below $L_2$. The preganglionic fibers to the cervical ganglia and to the ganglia below $L_2$ must reach them along the sympathetic cord, i.e., via the first thoracic ganglion in the case of the cervical ganglia, and via $L_2$ in the case of the lumbar and sacral ganglia (Figs. 1, 9, and 15).

Harman (1900) had already noticed that the limit of the preganglionic outflow may vary according to the fixation of the brachial plexus. As the plexus moves up a segment (prefixed), the preganglionic outflow moves up one segment to $C^8$, and in the case of a postfixed brachial plexus, the second thoracic ganglion may become the

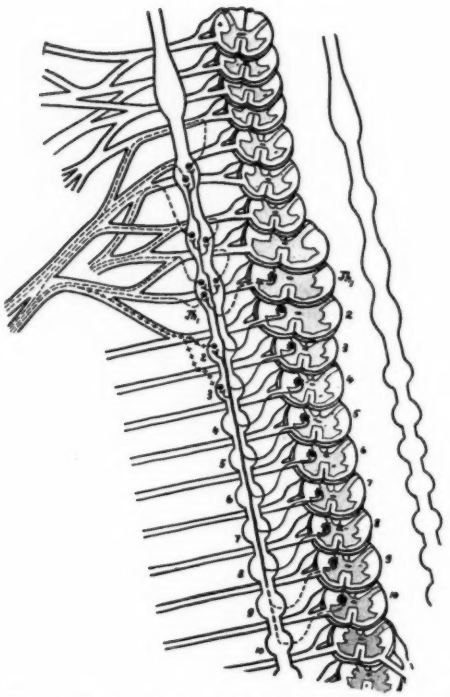

Fig. 9. Diagram showing preganglionic and postganglionic sympathetic fibers to the upper extremity. The uninterrupted preganglionic fibers are present in all cases; the interrupted ones are present in some cases. The postganglionic fibers indicated by a cross-line signify Kuntz's nerve.

highest cranial outflow. Foerster (1936) and Goetz and Marr (1944) have made similar observations. Correspondingly, $L_3$ instead of $L_2$ may become the lowest segment with sympathetic outflow.

Thus the peripheral sympathetic consists of three components: (1) preganglionic fibers taking their origin in the lateral horn (medullated, hence white rami); (2) paravertebral ganglia; and (3) postganglionic fibers (nonmedullated, hence gray rami).

### PHYSIOLOGICAL CONSIDERATIONS AND PREREQUISITES FOR SUCCESSFUL SYMPATHECTOMY

Toward the end of the last century, various authors demonstrated that in animals extirpation of the ganglia and degeneration of the sympathetic nerves induce an increased response of the affected organ to adrenaline. This sensitization phenomenon is found in all smooth muscle which is under the control of adrenergic nerve impulses. It has been reported for the denervated heart (Cannon, Lewis, and Britton 1926), the pupil (Meltzer and Auer, 1904; Meltzer 1904), and the nictitating membrane (Cannon and Rosenblueth, 1937, 1939), as well as for the peripheral vascular tree (Elliot, 1905; Freeman, Smithwick, and White 1934; White, Okelberry, and Whitelaw, 1936; Atlas, 1941[8]). Increased sensitivity to adrenaline is registered after interruption of either preganglionic or postganglionic fibers (Elliot, 1905; Grant, 1935; Ascroft, 1937). The postganglionic operation, however, renders the structures from two to three times more sensitive than preganglionic section (Hampel, 1935). Ascroft calculated that the sensitivity increases three times following section proximal to the ganglion, but ten times following the postganglionic interruption. McCloskie *et al.* (1937) found that this hyperreaction may become sufficiently intense to produce necrosis of the skin when adrenaline is injected intracutaneously in the lower forelimb of a dog after removal of the stellate ganglion.

Hypersensitivity to adrenaline following ganglionectomy or interruption of the postganglionic fibers constitutes a complicating factor in cases in which surgery is contemplated. It may actually bring a technically well planned operation into disrepute. It has been blamed for the relatively poor results of cervicothoracic ganglionectomy for the relief of vasospasm (Telford, 1935; Smithwick, 1936; Cannon, 1937; Learmonth, 1937) and some authors (White, Okelberry and Whitelaw, 1936; Smithwick, Freeman, and White, 1934) believe that it accounts for the recurrence of vasospasm in Raynaud's phenomenon. Ascroft (1937) and White (1940[202]) have actually demonstrated in monkeys that the good results of a preganglionic ramisection can be vitiated if the corresponding ganglia are subsequently resected. Ganglionectomy has therefore been entirely replaced by preganglionic ramisection, as suggested by Telford (1935) and by Smithwick (1936). For this reason the exact knowledge of the origin and the course of the *preganglionic* fibers to the various regions has become as essential as their postganglionic supply. There are, however, authors who do not subscribe to this view. Fatherree and Allen (1938) and Fatherree, Adson, and Allen (1940) showed that, although there was an increase in the sensitivity of the blood vessels to adrenaline after sympathectomy, there was no material difference whether the operation was of the preganglionic or postganglionic type. Grimson (1946) points out that the unsatisfactory results obtained in the upper extremities following sympathectomies have not been materially improved by operations

employing the preganglionic sympathectomy technique. The whole problem is at present being investigated by us and we are making use of more comprehensive methods of measuring the blood flow and vasomotor tone than were employed by previous authors.

Fatherree and his coworkers demonstrated that removal of the ganglia (postganglionic sympathectomy) in man does not produce nearly as great a sensitization of smooth muscle as it does in the monkey. This gives added point to our contention that the technique of the operations on the sympathetic system should be based on physio-anatomical data obtained from man and not from animals.

Knowledge of the preganglionic sympathetic outflow in man is still incomplete and often incorrectly stated, largely because it has been deduced by indirect methods or by attempts to apply to man the findings in laboratory animals.

This is further complicated by the fact that it has been found that the fibers of one anterior root may run up and down the paravertebral chain and that one preganglionic sympathetic neuron may synapse with as many as six to nine (Langley 1900) or even twenty postganglionic neurons (Billingsley and Ranson, 1918). This explains why stimulation of one white ramus, containing preganglionic fibers of one cord segment only, causes sympathetic effects over many skin segments. For instance, stimulation of the anterior root of $Th_{12}$ causes erection of hair over an area extending from $Th_7$ to $S_5$, i.e., on the whole leg and on the abdomen to well above the umbilicus. It causes sweating in all the lumbar and sacral dermatones. Similarly, stimulation of the anterior root of $Th_4$ causes erection of hair over an area extending from $C_5$ to $Th_6$ (Foerster, 1936); or, to give another example, stimulation of *one* anterior root containing preganglionic fibers to the hand (see page 428) results in simultaneous vasomotor changes in *all* fingers of that hand (Ray *et al.*, 1943). From such evidence it appears that each ganglion cell in the paravertebral ganglia is innervated by preganglionic fibers from a great number of spinal segments. It is in this way that the characteristic diffuse discharge from the sympathetic is achieved. From all this emerges the point that, unless we achieve interruption of all preganglionic pathways, there can be no permanent loss of sympathetic activity to the area in question.

Therefore, every operation on the sympathetic, in order to be successful, has to be: (1) anatomically complete; (2) preganglionic in type, and (3) extensive enough to guard against future regeneration of interrupted fibers.

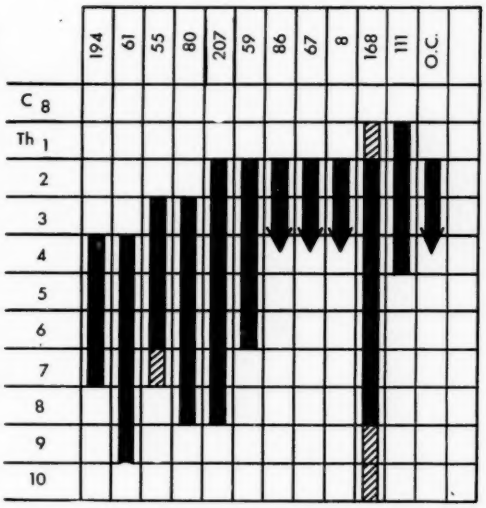


Fig. 10. Diagramatic representation of sympathetic outflow supplying the upper extremities, according to various authors. For explanation see text. *Black*—outflow present in all patients; *shaded*—outflow present in some. The arrows indicate that lower limit was not determined. Numbers across top of chart refer to the reference of the authors. O.C.—own cases.

Any modern schematic representation of the sympathetic system should take due consideration of these principles which constitute the prerequisites for successful operations on the sympathetic nervous system.

### THE SYMPATHETIC INNERVATION OF THE VARIOUS REGIONS

To make practical the afore-mentioned principles, a chart of the sympathetic innervation of the extremities and various organs in man should furnish the surgeon with the following information: (a) the origin and course of the preganglionic fibers, (b) their synapsis with the postganglionic neuron, and (c) the course and distribution of the postganglionic fibers. We therefore deal with the various regions and trace the pathways in that order.

*The sympathetic supply of the skin of the head, the neck, and the oculopupillary fibers.*

a. Origin of the preganglionic fibers—commonly in the lateral horn of $Th_1$ and $Th_2$; occasionally in $C_8$ and in $Th_{3-4}$ (Figs. 1 and 2).

b. Course of the preganglionic fibers—ascending in the sympathetic trunk.

c. Synapsis of the preganglionic with the postganglionic neurons—in the superior cervical sym-

Fig. 11.

Fig. 12.

Fig. 11. Sweating pattern following cauterization of left second thoracic ganglion. Note complete absence of sweating of whole upper extremity.
Fig. 12. Same patient as in Figure 11 following bilateral removal of $Th_2$.

pathetic ganglion, except for a few terminating in the middle cervical ganglion.

d. Course of the postganglionic fibers—they join the internal carotid for the structures of the orbit, the external carotid for the skin of the face, and the salivary glands and the cervical plexus ($C_1$ to $C_4$) for the skin of the neck. (Some fibers arising in the superior cervical ganglion join the phrenic nerve—Hovelacque, 1927.)

e. Comment: Exact information as to the sympathetic supply to the head and neck and to the ciliospinal centers in man is available from studies of Foerster (1936, 1939), Thomas (1926), Head and Riddoch (1917), and more recently from Hyndman and Wolkin (1942), Ray *et al.* (1943), and Sheehan (1941). The data are tabulated in Figure 2. Foerster stimulated the anterior roots and actually observed the individual qualities of sympathetic action. These were his findings (Fig. 2): If a strong sympathetic response was obtained on stimulation of the anterior root of $Th_1$, stimulation of $Th_2$ caused a less definite response, and vice versa. Dilatation of the pupil may be observed after stimulation of the roots of $C_8$, $Th_1$ and $Th_2$, but if on stimulation of $C_8$ a definite effect is observed, there will be none from stimulation of $Th_2$, and vice versa. Stimulation of $Th_1$, therefore, invariably produced a strong dilatation of the pupil in all cases. As for the vasoconstrictor and sweating fibers, they arose in the first and second thoracic segments only, while piloerection could be obtained on stimulation of the anterior root of $C_8$ as well. Thomas' findings were slightly different—he obtained sweating, dilatation of the pupil, and piloerection on stimulation of the anterior root of $C_8$ down to $Th_3$. Ray and his coworkers, on the other hand, tested for dilatation of the pupil only and in 1 of 10 patients they found a contribution from $C_8$. $Th_1$ contributed dilator fibers to the pupil in all patients, while $Th_2$ failed to do so in 2. In 4 of 10 patients dilatation was obtained on stimulation of the anterior root of $Th_3$ and 2 of these responded to stimulation of $Th_4$ as well. Different results were recorded by Hyndman and Wolkin (1942) who, after studying 5 cases, came to the conclusion that no sympathetic fibers supplying the skin structures of the face and the upper extremity leave the first thoracic root in man.

Our own experience goes to show that neither the orthodox view of Foerster and Thomas, nor the recently advanced idea of Hyndman and

Fig. 13. Sweating pattern characteristic for some patients following bilateral removal of $Th_2$, indicating complete interruption of sweat fibers to the extremities but no loss of sweating in face, neck, and trunk.

Fig. 14. Complete absence of sweating of hand following removal of left second thoracic ganglion.

Wolkin, is entirely correct. We have removed the dorsal sympathetic chain below $Th_1$ (below the stellate ganglion) in 42 cases, and in 18 cases (43%) thermoregulatory sweating of the face and neck was abolished (Figs. 3, 4, 11, and 12). This would conform to the findings of Hyndman and Wolkin, and confirm the fact that there was no sympathetic outflow from $Th_1$. In the remaining 57 per cent the skin structures of the face and neck were not denervated (Figs. 5, 6, and 7), which indicated that in these patients $Th_2$ was not the highest source of sympathetic outflow. Although there was this difference in the sympathetic supply of the skin in our cases, there were no differences in the sympathetic supply of the oculopupillary apparatus. In all patients in whom the sympathetic chain was excised below the stellate ganglion, Horner's syndrome was absent,[1] which indicated that the central connection of the oculopupillary apparatus via $Th_1$ is constant (Figs. 3 to 7). These findings have been confirmed by direct stimulation during operation (unpublished data). Our own investigations have taught us that sympathetic sweat, piloerector, vasoconstrictor, and pupillary fibers supplying the face and neck need not arise from the same segments and that no conclusions can be drawn from the absence or presence of any one as to the functional state of the others. This fact is of particular importance when assessing the recovery of sympathetic activity following sympathectomy. So far, no differences between the sympathetic innervation of the left and right side have been found. In fact, the exact symmetry of functional loss was remarkable (Figs. 7, 8, and 12) if one considers the differences often found in the anatomy at operation.

From this description of the sympathetic supply of the face and neck it is apparent that removal of the stellate ganglion (inferior cervical and first thoracic) constitutes in all cases a complete and almost pure preganglionic ramisection for the sympathetic fibers to the head and neck. It results in ipsilateral loss of sweating, loss of vasomotor tone, and Horner's syndrome in all cases. Sectioning of the anterior roots or white rami of both $Th_1$ and $Th_2$ will result in complete preganglionic interruption of the sympathetic pathways in about 60 per cent of the cases; in the remaining cases there will be an outflow from $C_8$, $Th_3$, and $Th_4$ (Fig. 1).

[1]Although occasionally a slight degree of transient Horner's syndrome obtained in a few cases.

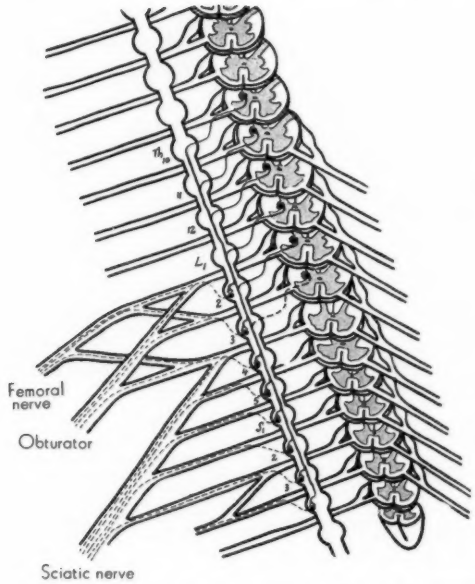


Fig. 15. Sympathetic pathways supplying the lower extremities. The interrupted preganglionic fibers are present in some patients only.

If the cord is sectioned below $Th_2$ as well, 90 per cent of the cases should be completely (preganglionic) sympathectomized and therefore should also show a positive Horner's syndrome. Sectioning of one white ramus alone, either $Th_1$ or $Th_2$, will in all cases interrupt but few of the sympathetic fibers, and no significant functional impairment can be expected. Removal of the second thoracic ganglion does not produce a Horner's syndrome and in 43 per cent of the cases it produced complete preganglionic sympathectomy of the skin structures of the face and neck. In the remaining cases there was no loss of any of the sympathetic functions in the face and neck. In any operation which leaves the preganglionic outflow from $Th_1$ intact, Horner's syndrome will not occur.

*The sympathetic innervation of the upper extremities.*

a. Origin of preganglionic fibers—commonly in the lateral horn of $Th_2$ to $Th_{8, 9}$ or $_{10}$, occasionally from $Th_1$ as well.

b. Course of preganglionic fibers—ascending in sympathetic trunk.

c. Synapsis of preganglionic with postganglionic neurons—in inferior cervical and first thoracic ganglion (stellate ganglion), with few synapses in the second and third thoracic and the middle cervical ganglion.[1]

d. Course of postganglionic fibers: the vast majority take their origin in the stellate ganglion, a few arise in the ganglia just mentioned, and all join the roots of the brachial plexus.[1]

e. Comment: The origin of the preganglionic fibers to the upper limbs is still a matter of considerable dispute, and sympathectomy of the hands is still of doubtful permanent value. First, it is interesting to note that the segmental outflow of vasoconstrictor and sudomotor fibers should come from as low as $Th_{8-10}$ (Fig. 9). However, from the surgical viewpoint, the upper level of the outflow is of greater importance. Our present knowledge is largely based on the early experiments of Langley, and Bayliss and Bradford. It is precisely here that the application to man of results obtained in animals has been confusing and actually misleading. Kuntz, Alexander, and Furculo (1938) demonstrated in cats a sympathetic outflow from $Th_1$ and suggest the same for man. Sheehan and Marrazzi (1942) could not confirm this in the monkey ($Th_4$ being the highest spinal outflow), and, as for man, numerous authors, from carefully controlled experiments, have given $Th_2$ as the upper limit (Foerster, 1936; Atlas, 1941; Hyndman and Wolkin, 1942; Goetz and Marr 1944). Ray *et al.* (1943) had occasion to stimulate the anterior dorsal root in man and found an outflow from $Th_1$ only in 1 of 11 patients (and in this 1, only on one (left) side, $Th_2$ having been the highest outflow on the right). Therefore, it appears justified to accept, for the present, $Th_2$ as the upper limit of the preganglionic sympathetic outflow to the upper extremities in man. The available evidence is summarized in Figure 10.

From all that has gone before, it is clear that removal of the stellate and second thoracic ganglions is a postganglionic sympathectomy. In order to achieve a preganglionic ramisection the stellate ganglion must remain intact and removal of only the second ganglion seems to be the ideal operation, particularly in patients who do not have Kuntz's nerve, i.e., no postganglionic fibers arise in the second paravertebral ganglion. This would occur in four-fifths of the cases, but in the other fifth some postganglionic neurons will necessarily be removed with the second thoracic ganglion. The sympathetic fibers of the second

[1]In 20 per cent of his cases Kuntz (1929) found a large branch passing from the second ganglion to the brachial plexus, and Perlow *et al.* (1935) demonstrated Kuntz's nerve in 3 of 24 cases. More recently Kirgis and Kuntz (1942) described a further branch which arises from the third thoracic ganglion, joining the second thoracic nerve central to the origin of Kuntz's nerve and contributing sympathetic fibers to the brachial plexus.

thoracic ganglion, however, apparently supply the upper arm only, the hand being innervated only by fibers from the stellate ganglion. Indeed, Hyndman and Wolkin (1942), and we ourselves (Goetz and Marr 1944), have suggested removing the second thoracic ganglion only, in order to achieve sympathectomy of the upper extremities, and in all cases this has resulted in immediate and complete sympathetic denervation, both as regards sweating (Figs. 11 to 14), and central vasoconstrictor tone. However, as Ray *et al.* (1943) have shown, an outflow from $Th_1$ occurs in less than 1 of 10 patients and in these this procedure is therefore not complete. There exists no method of determining such a case beforehand. Therefore, we have recently started to stimulate during operation the cut ends of the sympathetic trunk, the various rami, and the bed from which the sympathetic chain has been removed, and to record the vasomotor responses in the respective limb with our plethysmographic method (Goetz 1946). We thus hope to prove to our satisfaction during operation that the resection carried out is physiologically complete.

It has to be admitted that sympathectomy for the upper extremities has not given the ideal results so easily achieved in the lower limbs. After Kuntz's nerve had been described, the original operation (stellatectomy) was extended to include the second thoracic ganglion (Adson and Brown, 1929). This did not materially alter the situation, and sensitization was then regarded as the cause of the relapses. It was then that Telford (1935) and Smithwick (1936) demonstrated that the arm can be completely denervated by dividing the preganglionic rami of the second and third thoracic ganglia and cutting the sympathetic trunk below the third ganglion (preganglionic ramisection). The immediate results of this operation were far superior to those following stellatectomy. The late results still did not compare favorably with those following denervation of the lower extremities. Regeneration was then held responsible for the late relapses (Simmons and Sheehan, 1939; Smithwick, 1940). In order to prevent this, Smithwick recommended intraspinal root section of $Th_2$ and $Th_3$ and cutting of the trunk below the third paravertebral ganglion, as well as covering of the mobilized trunk with a cylinder of silk or cellophane. Finally, the free lower end of the trunk was transplanted into the muscle of the wound (Smithwick, 1940). White and Hamlin (1945) recently suggested the use of tantalum instead of the silk cylinder. Even such procedures did not prevent the recurrence of vasoconstrictor tone. The issue has by no means been clarified by a

Fig. 16. Roentgenogram of patient in whom bilateral splanchnicectomy has been performed for hypertension. Note clips fixed by surgeon during operation on all sympathetic fibers cut. Note lowest clip on right side below $L_2$, indicating that second lumbar sympathetic ganglion has been removed. On the left side the last clip is above the intervertebral disc between $L_2$ and $L_3$ and obviously the second lumbar ganglion has not been removed.

recent report of Skoog[1] who drew attention to sympathetic structures termed "intermediate ganglia" by Hirt, the significance of which had been overlooked in surgical texts. They are microscopic masses of ganglion cells, distributed without any definite rule in the communicating rami to the spinal nerve, often in closest proximity to the latter. Onodi was the first to mention ganglia in the rami communicantes of human embryos. Van der Broek, and Marinesco and Minea confirmed this, the latter pointing out that they are sympathetic in nature. Hirt found these ganglion cells in certain reptiles and coined the term "intermediate ganglia." Rossi, Gruss, and Wrete (221, 222, 223, 224, 225, 226) studied these ganglia in man and in 1941 Wrete pointed out that it is not impossible that these ganglion cells send postganglionic fibers to the nearby spinal nerve, which may escape during standard sympathetic denervation. Skoog, working in Wrete's laboratory, de-

[1]References in this paragraph only are to be found under "Additional References."

scribed these ganglia in more detail in the cervicodorsal region of 5 adults. He, like Wrete, assumes that we are dealing with motor ganglion cells and he visualizes two possible pathways by which they receive their preganglionic supply: (1) via the sympathetic trunk, and (2) directly from the spinal nerve next to which they are lying. If the former is true then the significance of the intermediate ganglia is less important from the surgical point of view, since removal of the chain will automatically denervate them. However, if the latter should be correct, then we would be dealing with entirely intraspinal sympathetic pathways, not accessible to the surgeon by the standard methods employed in interrupting the sympathetic supply. Therefore, the intraspinal sympathetic pathways could easily explain failures following the usual operations. However, it is important to realize that the ganglia are also found in the lumbar region (Wrete, 223, 225, 226) where sympathectomy, after all, is lasting and complete. This strongly supports the concept that the preganglionic supply to these ganglia reaches them via the chain and not directly from the spinal nerve. However, further investigations (particularly physiological) concerning these structures are required before a definite opinion can be formed as to their significance in surgery on the sympathetic nervous system.

In 1942 Geohegan and Aidar suggested that recovery of sympathetic tone may be due to reorganization of function within the sympathetic system itself. They cited a case (Ray *et al.*, 1942) in which the ventral roots from the second to the ninth thoracic segment were sectioned. Complete sympathetic denervation of the hand resulted, but after 10 weeks function returned. The authors pointed out that this could not have been due to regeneration on account of the short time interval, and they think that pathways were used which before operation did not carry sympathetic impulses to the hand. They suggest that the first thoracic root which, as we have seen, ordinarily carries no vasoconstrictor fibers to the upper extremities, may develop such function after the usual pathways have been interrupted. They put this theory to the test in cats and found that after interruption of all preganglionic pathways to the forepad, new pathways developed from higher spinal roots which normally contribute no outflow to the upper extremities. It is quite conceivable how this can happen in a case like the one illustrated in Figs. 5, 6, and 13, but it would be more difficult to conceive in the cases in which the structures of the skin of the face and neck have no origin from $Th_1$, the highest outflow being from $Th_2$ only. In this respect it is interesting that De Takats (1940) suggested extending the original (postganglionic) cervicodorsal sympathectomy to include the intermediate and inferior cervical as well as the first, second, and third dorsal ganglia. In 16 cases in which he followed this procedure, the results were, in his opinion, comparable with those obtained from lumbar sympathectomy. We are preparing a follow-up of our series of cases in which the second thoracic ganglion only was removed. Late relapses occurred in some patients from 10 to 12 months after the initial good result. This may have been due to reorganization in the sense of Geohegan and Aidar. We shall have to put this point to the test by subsequent sectioning of the white ramus supplying the stellate ganglion. For the present we have extended our operation to include resection of $Th_2$, $Th_3$, and $Th_4$ and in some cases we are following De Takat's (1940) suggestion. The results will be communicated in the near future.

In going through the literature it appears to us that many authors do not fully realize that, as we have pointed out on numerous occasions, the sympathectomized vessel still reacts with constriction to the local application of cold. It is only the central vasoconstrictor impulses, as they occur with emotional strain and excitement, which are abolished by sympathectomy. Raynaud's phenomenon, as produced by the local application of cold, may therefore persist following sympathectomy. The vessels will react as well to direct-acting constrictor substances circulating in the blood. If we keep these facts in mind then our hopes of relieving Raynaud's phenomenon by sympathectomy in every case will be less high and our disappointment less acute.

*The sympathetic supply to the thoracic and abdominal wall.* This may be quickly disposed of, since it is of little clinical importance. The preganglionic fibers arise in the lateral horn of the corresponding segments and reach the paravertebral ganglia where the synapsis of the postganglionic fibers is to be found. The neurons of the latter join the spinal nerves, as is the rule for somatic areas. It appears, therefore, that we have a strictly segmental distribution.

*The sympathetic supply to the lower extremeties.*

a. Origin of the preganglionic fibers—in the lateral horn of $Th_{10}$ to $L_{2(3)}$.

b. Course of the preganglionic fibers—descending in the sympathetic trunk.

c. Synapsis of preganglionic with postganglionic neurons—in $L_4$ to $S_5$ for the foot and the lower leg, and in the ganglia of $L_1$ to $L_3$ for the thigh and medial aspect of the lower limb.

d. The postganglionic fibers take their origin in the ganglia corresponding to the lumbosacral plexus, i.e., $L_4$ to $S_3$ for the sympathetic fibers joining the sciatic nerve, and $L_1$ to $L_3$ for the fibers joining the femoral and the obturator nerve.

e. Comment: As a rule the lowest preganglionic sympathetic outflow is via the anterior root of $L_2$ and all lower sympathetic ganglia receive their preganglionic supply via the second lumbar ganglion (Fig. 15). The second ganglion therefore holds a key position and its removal results in complete interruption of the sympathetic pathways to all the lower ganglia and, hence, complete sympathectomy of the foot. This is well illustrated by Figures 16 and 17 obtained from a patient who elsewhere underwent transdiaphragmatic splanchnicectomy for hypertension. The clips fixed by the surgeon (Fig. 16) indicate that on the right side $L_2$ was removed, but on the left side the first lumbar ganglion only was resected. Clinically, the right leg only was sympathectomized, and plethysmographic examination (Fig. 17) indicates complete ablation of central vasomotor control on the right and normal sympathetic activity on the left. Incidentally, this clearly demonstrates the importance stressed previously (Goetz 1947) of checking every case of splanchnicectomy as to the completeness of the operation.

Since, however, in a small number of cases there is some outflow from $L_3$ (*vide* p. 423), the standard lumbar sympathectomy for cases of vascular deficiency in the foot and lower leg is removal of the second and third lumbar ganglia, which is automatically preganglionic in type (Fig. 15) and presents no problems. At Groote Schuur Hospital we do not consider lumbar sympathectomy a serious major operation and it is efficiently carried out by the general surgical staff by means of the extraperitoneal approach on both sides in a one-stage operation. None of the postganglionic fibers is interrupted. They take origin from $L_4$ downward. Some surgeons remove $L_4$ as well, which, as the chart illustrates, is not only unnecessary, but it should remain untouched.[1] As for $L_1$, its removal bilaterally in the male will cause sterility through paralysis of the ejaculatory mechanism. No untoward effects have been recorded in the female. Removal of $L_2$ and $L_3$[1] usually causes loss of sympathetic activity from the knee downward. When $L_1$ is left intact, an area on the inner aspect of the lower limb to just above the ankle, corresponding to the saphenous nerve arising from the femoral nerve, can be mapped out in some cases in which sympathetic control has not been abolished (Figs. 18 to 19). Therefore, we recommend removal of $L_1$ in the cases in which the question of sterility does not concern the patient. In cases in which the release of vasoconstrictor tone well above the knee has to be aimed at, it is always advisable to remove $L_1$. We have, however, to point out that removal of $L_1$ to $L_3$ constitutes a postganglionic sympathectomy for the sympathetic fibers joining the femoral and obturator nerves. So far well over 200 lumbar sympathectomies have been carried out at Groote Schuur Hospital. In each, $L_2$ and $L_3$, and occasionally $L_1$, have been removed. In all cases a complete sympathectomy has been achieved and

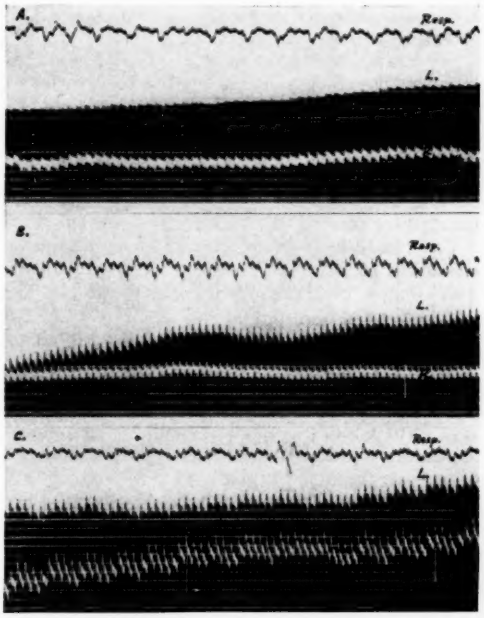


Fig. 17. Plethysmographic tracing of the blood flow simultaneously recorded in the two lower extremities of the same patient as in Figure 16. *A*. Blood flow during rest. Upper record—left; lower record—right big toe. Resp. = respiration. Note pulse volume in the left limb is slightly smaller than in the right one. *B*. Thirty minutes later following body heating. No increase in pulse volume of the right limb (lower record) but marked increase in the pulse volume of the left limb (upper record), indicating release of the vasoconstrictor tone in the latter. *C*. Following local application of heat to the right limb. Note the increase in pulse volume of the right limb, indicating that there is no organic vascular disease present and that the failure to dilate in *B* was due to interruption of the sympathetic pathways.

[1]The arrangement of the ganglia in the lumbar region varies a great deal, the ganglia fusing with each other, often in a complex fashion, and leading to duplication of the intervening trunk, so that recognition of the individual ganglion is often impossible (Perlow and Vehe, 1935; Pick and Sheehan, 1946).

is still complete in the patients operated on as long as from 10 to 15 years ago. Reflex vasomotor activity has not recurred in a single case! It appears obvious, therefore, that removal of $L_4$ in order to prevent regeneration is not justified, removal of $L_2$ and $L_3$ being entirely sufficient. Interlumbosacral sympathectomy, a procedure recommended by Danielopolu *et al.* (1933), which consists in sectioning the chain below $L_4$, is not to be recommended for reasons obvious from Figure 15.

*The sympathetic innervation of the organs in the thorax (in particular of the heart).*

a. Origin of the preganglionic fibers—in the lateral horn of $Th_1$ to $Th_5$ (6).

b. Course of the preganglionic fibers—part of the fibers arising in $Th_{1-3}$ ascend to the cervical ganglia; most of the fibers go to the corresponding paravertebral ganglia.

c. Synapsis of preganglionic with postganglionic neurons—in the three cervical ganglia and the upper five thoracic ganglia.

d. Course of the postganglionic fibers—they arise in the three cervical ganglia and form the three cardiac nerves to reach the cardiac plexus. In addition, there are direct fibers from the paravertebral ganglia to the cardiac plexus.

e. Comment: Surgery of the heart hardly ever calls for interruption of the sympathetic motor fibers, and the surgeon's interest centers around the sensory pathways which join the sympathetic system. Although this article does not deal with the sensory pathways, we cannot fail to mention here surgical procedures on the sympathetic system adopted in the treatment of pain in coronary disease. Certain authors still hold (Reid and Andrus, 1944) that all sensory fibers of the heart can be interrupted by excision of the stellate ganglion. This is definitely not so. The pathways for cardiac pain are essentially the same as those just traced for the motor cardiac fibers (Ionescu *et al.*, 1928; White *et al.*, 1933, McEachern *et al.*, 1940, Kuntz and Morehouse, 1930). Some fibers ascend via the middle and lower cardiac nerve to the middle cervical and the stellate ganglions and thereafter descend to the upper three thoracic ganglia to reach the cord via the corresponding white rami and posterior roots (Fig. 21). Twice as many fibers, however, run across the posterior mediastinum to reach the upper four to five, possibly six to seven (Saccomanno, 1943) thoracic ganglia directly, which they pass without interruption to proceed via the white rami to the posterior root ganglia. The superior cardiac nerve apparently does not conduct cardiac pain. Hence, the surgical approach must be either at the thoracic ganglia (White, 1944) or at the white rami (Raney, 1939), or, alternatively, at the posterior roots (Davis, 1933). The latter has the advantage that there is no interference with efferent fibers.

François Franck (1899) was the first to suggest sympathectomy for angina pectoris, and Jonnesco (1920) was the first to carry out the operation in 1916. He removed the entire cervical sympathetic chain, including the stellate ganglion, bilaterally. In the following years this operation was carried out by numerous surgeons who reported good results (Coffey and Brown, 1923; Brown, 1923; Bacon, 1923; Bruening, 1923; and Cutler, 1932). Kerr (1936) reported complete relief of pain in 14 of 30 patients operated on in this manner and Leriche in 1936 advocated stellatectomy for the same purpose. The good results claimed for these procedures are difficult to explain in the light of recent anatomic and physiologic findings. Indeed, Learmonth (1937) and Ochsner and DeBakey (1937) report a large number of failures from cervicothoracic sympathectomy because of the failure to interrupt the direct afferent fibers.

The ideal procedure is obviously resection of the upper four or five posterior roots, which gives consistent relief from coronary pain (Davis, 1933; Haven and King, 1942; Ray, 1943). The effectiveness of resection of the upper three thoracic sympathetic ganglia, through which most of the sensory axons run, has been found by White and Smithwick (1941) and White (1944) to approach 100 per cent. In patients who are good enough operative risks there is no evidence that relief from pain has any but a favorable effect. While severe constricting pain which radiates to the precordium and inner arm disappears consistently following the destruction of these pathways, other nonpainful sensations persist, such as a sense of fullness in the upper end of the sternum, vasomotor changes in the face and the neck, palpitations, and dyspnea. Such residual sensations afford an adequate warning signal to the patient, indicating that he is straining his heart. There is evidence that these nonpainful impulses are probably transmitted over the vagus.

Unfortunately, the selection of patients who are good enough operative risks to withstand the procedure is not easy, and many of the worst sufferers have too poor a coronary circulation to withstand an operation of this nature. In these the alcohol injection into the paravertebral ganglia, as advocated by Mandl (1925), has been the solution (White and White, 1928; Levy and Moore, 1941; White, 1940 [201]; Perlow, 1942). As White (1944) has pointed out, interruption of the pathways of pain may have a beneficial effect on the coronary circulation as well.

Fig. 18.

Fig. 19.

Fig. 18. Typical sweat pattern following removal of the left second and third lumbar ganglia. Note sweating on the inner aspect of the left leg extending down to the ankle.
Fig. 19. Same patient as in Figure 18. Outer aspect of left leg. Note complete absence of sweating of foot.

*The sympathetic supply to the abdominal viscera.*

a. Origin of the preganglionic fibers—in the lateral horn of $Th_{(3,4)\ 5}$ to $L_2$.

b. Course of the preganglionic fibers—they pass through the corresponding paravertebral ganglia to form the three splanchnic nerves. The fibers from $L_1$ and $L_2$ reach the aorticorenal plexus directly (Fig. 22).

c. Synapsis of the preganglionic with the postganglionic neurons—in the solar plexus (celiac, superior mesenteric, and aorticorenal ganglia).

d. Course of the postganglionic fibers—they form a plexus around the main blood vessels which they join to reach the various organs.

e. Comment: The solar (celiac) plexus is the large nerve mass on each side of the celiac axis continuous with a network of sympathetic nerves in relation to the aorta. Bichat (1802) considered that the solar plexus constituted the termination of the two great splanchnic nerves. However, it is known that the solar plexus receives not only gray and white fibers from the thoracic sympathetic, but also fibers from the lumbar sympathetic, the right vagus, and perhaps from the phrenic nerve (Hovelacque, 1927). The solar plexus comprises a dense meshwork of fibers with aggregates of a number of secondary ganglia in relation to the branches of the aorta. The classic description supposes that there are six well formed individual ganglia, the semilunar (celiac) ganglia, the aorticorenal ganglia, and the superior mesenteric ganglia. It must be realized, however, that this is only a schematic representation and that the ganglia fuse and split up into many variations which it is not possible to describe in this article.

The sympathetic innervation of the suprarenal gland is also preganglionic in origin, being supplied via the splanchnic and directly from $L_1$ and $L_2$ (Elliot, 1913; Hoshi, 1926; Hollinshead, 1936). The preganglionic fibers end in relation to the secretory cells in the medulla. The latter are therefore morphologically comparable to the postganglionic neurons in the paravertebral ganglia. The most convincing evidence to this effect has recently been furnished by Hammond and Yntema (1947). After removal of the neural crest in chick embryos, sympathetic neurons in the paravertebral ganglion chain and the chromaffin cells of the suprarenal medulla were absent.

The splanchnic nerves have gained considerable prominence within recent years on account of the surgical treatment of hypertension, which aims at sympathetic denervation of the splanchnic area.

We know that the splanchnic bed is man's mechanism for maintaining his blood pressure level relatively constant in the lying, sitting, and standing positions. If the splanchnic is well denervated, the blood pressure level should fall as the patient changes from the lying to the sitting and standing positions. Indeed, such a change has

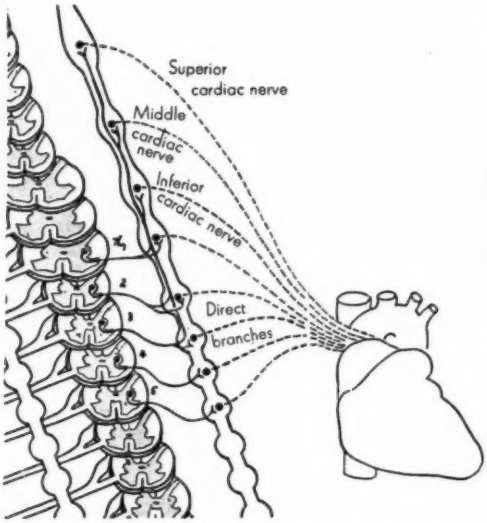


Fig. 20. Efferent sympathetic cardiac pathways.

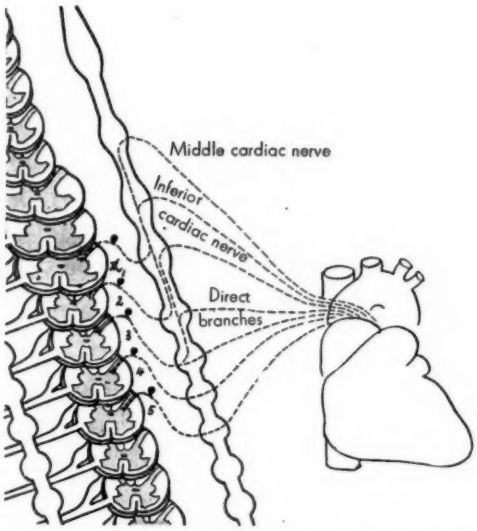


Fig. 21. Diagram of afferent (pain) cardiac sympathetic fibers. Note direct branches and absence of pathway via superior cervical ganglion.

followed splanchnic resection by laminectomy and anterior root section, although this operation, in addition to interrupting the sympathetic motor pathways, also divides somatic motor nerve fibers. The latter results in extensive muscular paralysis of the abdominal wall.

Several operations have been employed, connected with the names of Pieri (1927), Craig (1934), Adson and Brown (1934), Peet (1935), and Crile (1938). The operation practiced by most surgeons is that devised by Smithwick (1940).

The operative technique should comply with the three cardinal points, viz., it should (1) be anatomically complete (*vide* p. 425), (2) be preganglionic in type, and (3) safeguard against future regeneration. Smithwick suggested transdiaphragmatic removal of the ganglionic chain extending from $Th_9$ down to $L_2$ and extirpation of a long segment of the greater, lesser, and least splanchnic nerves, the celiac ganglion to be left intact. Such an operation is followed by postural hypotension, but unless a postural change in blood pressure follows splanchnic resection, it is not certain that the maximum change in blood pressure has been produced. Thorough denervation of the splanchnic bed and removal of the lumbar chain also give a reasonable guarantee that the kidneys and the adrenal glands are denervated as well.

During the operation the kidneys, adrenal glands, and the paravertebral regions should be carefully explored in order to obtain all possible information regarding renal pathology and to exclude adrenal tumors and paragangliomas.

In discussing the surgical treatment of hypertension, Grimson (1942) states that the fall in blood pressure has been directly proportional to the extent of the sympathectomy and inversely proportional to the severity of the disease. He therefore advocates total sympathectomy which, as he points out (Grimson, Wilson, and Phemister, 1937), also prevents neurogenic elevation of the blood pressure as produced by increase in the intracranial pressure. We (Goetz, 1947) have pointed out that the operative procedure suggested by Smithwick does not fulfill the first prerequisite for successful operation, i.e., it is not anatomically complete in that sympathetic pathways from the dorsal ganglia above $Th_9$, forming the preaortic and esophageal plexus, are not interrupted. As we have pointed out earlier, these plexuses link up with the solar plexus and, we may add, the phrenic nerve, which receives its sympathetic supply from the superior cervical ganglion, has been found to send connections to the celiac ganglion. We have drawn attention to the possibility that the body may re-establish sympathetic control of the splanchnic area in this roundabout way (Goetz, 1947), and we felt that such reorganization, rather than regeneration, may account for

the failures in some cases following the Smithwick operation. From the experiments of Geohegan and Aidar (1942) we know that in other regions such re-organization is the rule rather than the exception. There is, therefore, strong evidence in favor of carrying out a more extensive procedure than has originally been suggested by Smithwick, and at Groote Schuur Hospital we aim at total sympathectomy through an incision removing the tenth and part of the ninth rib, the sympathetic chain being at present removed from $D_2$ to $L_3$ intact with its connections forming the splanchnic nerves and the direct branches to the organs in the mediastinum and the heart (Fig. 23).

Those who had expected the Smithwick operation to be a cure-all for hypertension must be sadly disappointed. It is obvious that when cardiac and renal function are both significantly impaired, no operation can be successful. Everyone who has had reasonably wide experience with the operation, however, will admit that in some cases it has produced a permanent fall in the blood pressure which, for all practical purposes, constitutes a cure. Regression of eyeground changes, decrease in the size of the heart, improvement in the electrocardiogram, increase in the renal function, and relief of the symptoms are noted in many cases. The difficulty still arises in selecting the correct patients for operation out of the great number of potential candidates. Smithwick (1944) has published his grading criteria, yet our own experience has shown that they are not as helpful as suggested by him in predicting the ultimate results of the operation. Some patients, who should have responded well according to these criteria, benefited very little or not at all from the operation, while others, on whom the operation appeared to be misplaced, gave "group 1" responses. It is to be hoped that it will eventually be possible to define the indications for the operation more clearly so that a higher percentage of patients will be benefited by the operation as judged by a persistent and significant fall in the blood pressure. "Although it is not yet established that the results will be permanent, at least there is good reason to believe that the hands of the clock can be set back for a number of years in the majority of younger patients with hypertension who have not been permitted to progress to the stage of advanced degenerative changes in the arteries of the kidneys, heart, and brain" (White 1944). If it is realized that it is very rare for the increased blood pressure to return spontaneously to normal values, for any length of time, and that a large majority of patients with hypertension die at a relatively early age of the sequelae of hypertension, such as cardiac failure and cerebral accidents, then the importance of this operation cannot be overestimated.

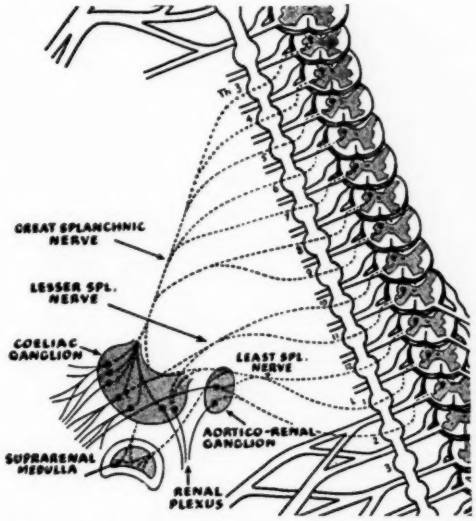


Fig. 22. The anatomical arrangement of preganglionic (interrupted) and postganglionic (uninterrupted) sympathetic pathways to the splanchnic bed.

## CONCLUDING REMARKS

Cannon and his coworkers (1929) and McDonough (1939) have demonstrated that an intact sympathetic nervous system is not a *sine qua non* in a protected and constant environment, and totally sympathectomized cats and dogs may thrive under such conditions. The stresses and strains which are met with in the normal existence, however, make its integrity essential. According to Cannon, whose views have been extremely well expressed by White, we should think of the sympathetic nervous system as an emergency protective mechanism which is not functioning all the time but which is always ready to go into action to combat any variety of adverse circumstance, either in the surroundings or in the internal machinery. This co-ordination of the body as a whole to meet changing conditions in its internal and external environment by autonomic adjustment has been called "homeostasis" by Cannon. Homeostasis frees the individual from the difficult task of paying routine attention to the management of the details of bare existence. Without homeostatic control, the warmblooded animal would be in constant danger of disaster unless always on the alert to correct voluntarily

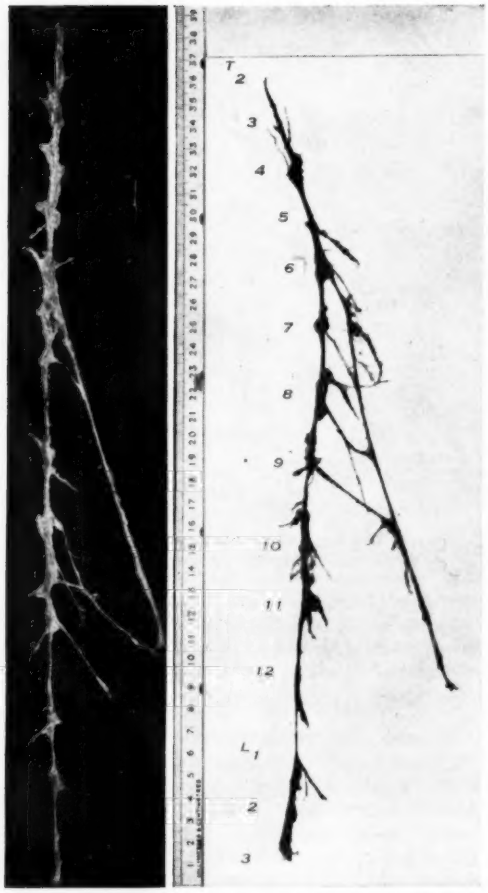


Fig. 23. Two typical specimens of the sympathetic chain and splanchnic nerves as removed by subtotal sympathectomy at Groote Schuur Hospital for hypertension.

what the sympathetic nervous system regulates in a purely automatic fashion.

Some of the most common conditions which arouse sympathetic activity are pain, emotional excitement, extremes of temperature, asphyxia, hemorrhage, strong muscular exercise, dehydration, and hypoglycemia. Furthermore, any form of intense emotion or psychic trauma stimulates a generalized sympathicoadrenal discharge. It is such conditions which cause particular strain on the vascular system of patients already suffering from hypertension or from structural vascular disease. On the other hand, we must not lose sight of the fact that the autonomic nervous system is not a purely motor system under control of higher centers, but that sensory impulses arising in smooth muscle, ligaments, joints, and glandular tissue, control, to a large extent, sympathetic motor activity in a purely segmental reflex fashion. The indications for sympathectomy, then, are to be found among such conditions in which there is either a central or peripheral disturbance of the reflex proprioceptive regulatory function of the sympathetic nervous system. Man, being capable of protecting himself against adverse circumstances and of creating a constant environment for himself, can fortunately continue to exist after a large portion, or even the whole, of the sympathetic chain has been removed.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### EYE

**Parathyroid Deficiency.** DONALD J. LYLE. *Am. J. Ophth.*, 1948, 31: 580.

The ocular syndrome of cataract and papilledema is rare as only 21 cases have been reported in the world literature. The cataract produced by parathyroid deficiency, however, is of relatively frequent occurrence. Parathyroid deficiency may be idiopathic, as the result of lack of growth or degeneration of the glands, or as a result of operation. At a latent stage, the symptoms of hyperneuromuscular excitability are present only upon local nerve stimulation or irritation. At a manifest stage, the deficiency is characterized by generalized spontaneous convulsions, in addition to ectodermal changes. The neuroectodermal symptoms, i.e., mental disturbances, and increased intracranial and cerebrospinal pressures with papilledema, appear.

The diagnosis of parathyroid deficiency is made by means of the laboratory tests of the blood calcium and phosphorus, added to the signs of excessive neuromuscular irritability. The normal calcium content of the blood varies within the limits of 9 and 11 mgm. per 100 c.c. In cataract tetany or parathyroid deficiency, the level drops to 7 or 8, and in manifest tetany, as low as 4. The phosphorus content, which is normally between 2 and 4 mgm., is relatively or absolutely increased in proportion to the calcium content. A differential diagnosis must be made from idiopathic epilepsy and brain tumor.

The case of a 53-year-old woman, who was examined because of failing vision, is reported. Years previously, she had undergone a thyroidectomy. Since then, she lost her hair, her skin was dry, and her nails were brittle. Her corrected visual acuity was reduced to 20/100 in the right eye, and 20/40 in the left eye. Diffuse posterior subcortical opacities were found in the lenses; and the fundi were normal. There was a slight elevation of the intraocular pressure. On the basis of the presence of the positive Chvostek and Trousseau signs, a low blood calcium (8.1 mgm. per 100 c.c.), and the history, a tentative diagnosis of postoperative parathyroid deficiency was made. During the 3 years following, the lense opacity increased to a mature cataract. The intraocular pressure fluctuated, apparently rising with the reduction of calcium and falling when the calcium returned to a normal level. After a cataract extraction in the right eye, a cyclodialysis operation became necessary; later, some permanent central corneal opacities developed. An uneventful cataract operation was performed upon the left eye. On the ninth day, however, the patient developed a generalized convulsion lasting 4 minutes and preceded by a loud, piercing scream. From the anamnesis, it was found that the patient had had six similar seizures in the last 5 months. On postoperative examination the patient seemed quite confused, disturbed, and blind. The ophthalmoscopic examination revealed clear media but a papilledema of considerable amount, with parapapillary venous engorgement without hemorrhages. The visual fields were markedly constricted. Roentgenograms of the skull, orbit, and intracranial contents were normal. Immediate improvement began with the administration of dihydrotachysterol and calcium lactate. Convulsions and twitchings ceased after the first day. The mentality cleared. The visual fields improved and the papilledema, though still present, seemed to be reduced considerably at the end of the first week. MICHEL LOUTFALLAH, M.D.

**Pterygium.** EMANUEL ROSEN. *Brit. J. Ophth.*, 1948, 32: 300.

A new technique for pterygium surgery is described and illustrated. The pterygium is excised from the cornea with a sharp knife and folded back underneath itself to be sutured under the caruncle. The conjunctiva is closed horizontally from the buckled end of the pterygium to the limbus.

The advantages offered are:

1. The head of the pterygium is brought into contact with the caruncle which is a modified cutaneous structure.

2. The direction of the growth of the pterygium is completely reversed.

3. The episcleral tissue fuses with the episcleral tissue.

4. The pterygium is completely buried.

EARL H. MERZ, M.D.

**Obliteration of the Central Artery of the Retina. Partial Recuperation of Vision and Retinographic Appearance** (Obliteración de la arteria central de la retina. Recuperación parcial de la visión y aspectos retinográficos). J. LIJÓ PAVÍA and MAURICIO LIS. *Rev. oto-nuero oftal. cir. Neur.*, 1947, 22: 97.

The authors state that obliteration of the central artery of the retina has been attributed to many causes, and they review the works of the various authors to date who have attributed obliteration of the retinal central artery to embolism or thrombosis. To these two factors the authors wish to add the factor of angiospasm which is becoming of increasing importance.

The authors think that in patients more than 60 years of age thrombosis and embolism prevail. In those between 55 and 60 years old the principal factor is angiospasm.

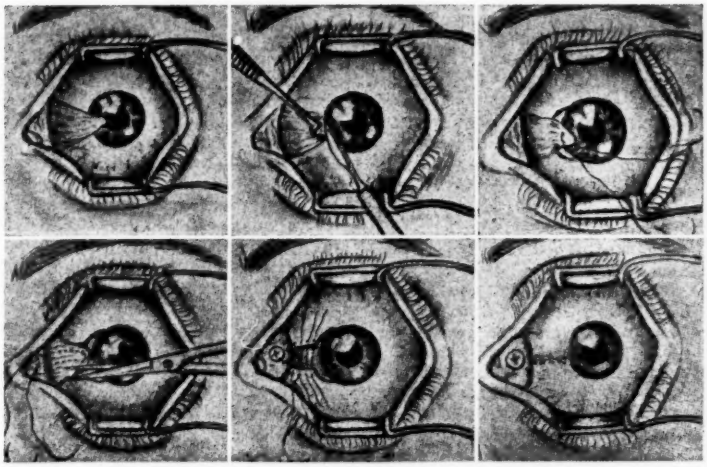

Fig. 1. (Rosen). This is a diagrammatic representation of the various steps in the operation for pterygium. a, Characteristic pterygium before operation. b, Pterygium being severed from the cornea and dissected back to its base. c, Double armed suture placed through pterygium head and emerging from the episcleral side. A small area of conjunctiva is undermined at each limbal area and appears like a small crescent. d, Each arm of the suture is passed underneath the pterygium and brought out through the caruncle. The pterygium is separated from the sclera with the scissors at its upper and lower borders. e, The double armed suture is tied over a small rubber button. The upper and lower free edges of the conjunctiva are sutured with three or four single sutures. f, The conjunctiva is completely approximated.

Two cases recently studied by the authors are reported. In one of these the authors followed the characteristic changes of the retina with excellent retinographic photographs until the retina slowly returned to normal.

The authors conclude that the essential factor upon which the nutrition of the retina depends is the choreocapillary circulation which may or may not be sufficient to conserve the vision. The result, therefore, may be intense anemia of the internal layers which may result in loss of transparency and complete atrophy. W. FOSTER MONTGOMERY, M.D.

## EAR

**A Contribution to the Question of Otitis Media in Infants.** ANDREJ MARES. *J. Lar. Otol.*, Lond., 1948, 62: 207.

The author states that it is generally acknowledged that infants during the first year of life are more susceptible to otitis media, for two reasons: (1) the greater susceptibility of the infant to infection; (2) the anatomical peculiarities of the infant middle ear: (a) the relatively short, wide, almost horizontal eustachian tube, and (b) the remnants of embryonic middle ear mucosa.

Otitis media in infants is classified as follows: (1) Witmaack's otitis media neonatorum; (2) catarrhal and suppurative otitis media: (a) manifest or latent, and (b) primary or secondary to any concurrent infection elsewhere.

The relationship between infection of the gastrointestinal system and otitis is considered, reference being made to I. E. Ebbs who found that of 238 infants with gastroenteritis, 81 per cent also displayed otitis. In the symptomotology of otitis media in infants, weight loss and gastrointestinal infection are more prominent symptoms and pain in the ear a less prominent symptom of otitis than in older children and adults.

The author attempts to show that the appearance of the ear drum, if carefully examined, is a reliable guide in making a diagnosis of otitis media in infants, and believes there is general agreement that myringotomy should be performed in all cases of obvious or doubtful disease of the tympanic membrane.

One-hundred and one cases of suspected otitis media in infants under 1 year of age are surveyed. When otoscopy revealed the slightest deviation from normal, myringotomy was done (in 92%), and a diagnosis of otitis media was made in 79 cases (78.2%). In 19.9 per cent of the 79 infants, mastoidectomy was performed with a mortality rate of 27 per cent.

The average amount of time required for treatment of the infants with uncomplicated disease was 14 days; the time required for treatment of those with complications was 5¾ weeks.

The dosage, or incidence of use of penicillin and sulfonamide drugs in the treatment of otitis media in infants is not clearly given; however, the author states that the results were rather less effective and very slow as compared to the results in older children. He believes this may indicate that many of these cases are secondary complications of gastroenteritis. The findings in each case are tabulated.

JOHN J. BALLENGER, M.D.

**The Surgery of Otosclerosis** (La chirurgie de l'otospongiose). RAYMOND PHILIP. *J. méd. Bordeaux*, 1948, 125: 63.

The author presents his method of fenestration for the treatment of deafness due to otosclerosis.

The disease process itself is considered as evolving in three periods:

1. A period of invasion of the capsule when treatment is primarily medical.
2. A period of progression toward stapedovestibular ankylosis without labyrinthine alteration.
3. A period of labyrinthine atrophy with diminishing bony conduction.

The second period is the surgical phase of the illness, in the course of which 80 per cent of those operated upon can recuperate sufficient hearing for normal conversation. Surgical treatment in creating a fistula and new tympanic system betters the hearing and also seems to arrest the evolution of the disease.

The operative technique is described in detail and the complications and end-results are discussed.

EDWARD W. GIBBS, M.D.

**The Fenestration Operation.** E. R. GARNETT-PASSE. *Irish J. M. Sc.*, 1948, Ser. 6: 145.

The author reports his experiences with the fenestration operation in more than 600 cases. With regards to the selection of cases for operation, Garnett-Passe classifies cases of clinical otosclerosis into three groups, in each of which a certain result may be expected.

Group 1 consists of cases in which the reserve of cochlear nerve function is adequate. The prognosis in this group is that from 80 to 90 per cent of the patients will have restoration of hearing to the practical hearing level.

Group 2 consists of the borderline cases, which show cochlear nerve damage to such an apparent extent that maximum provement is necessary to obtain a practical hearing level. Success in this group is anticipated in only about 20 to 40 per cent of the cases.

Group 3 consists of the cases with the cochlear nerve so far deteriorated that the chance of improvement from fenestration is practically nil. The author considers paracusis willisiana a sign which should be carefully observed before a patient is selected as suitable for the operation. This is a questionable factor because patients are not always reliable in reporting or recollecting this phenomenon.

In reporting his operative procedure the author emphasizes that hemorrhage must not be allowed to occur, and trauma to all tissues must be kept to a minimum. Pentothal anesthesia after heavy premedication is preferred by the author, with novocain and adrenaline injected into the site of incision. Magnification is obtained by using the binocular loupe microscope and constant irrigation is employed to wash away bone dust and to keep the field clear of blood. The author states that he uses his own modification of Shambaugh's enchondralized fenestra, which is much longer than either Lempert's or Shambaugh's, and more of the endosteal bone is exposed. The author describes his technique of extensive removal of the periosteal bone, which leaves only a thin eggshell layer of the endosteal bone extending posteriorly from the anterior end of the dome of the vestibule over the ampulla and a downward bend of the lateral semicircular canal to the posterior canal.

Garnett-Passe states that he has given up the use of the cartilage stopple and is at present working with solutions of antihistamine agents in an attempt to decrease postoperative labyrinthitis, but he does not describe the technique of their use.

The author's experience regarding relief of tinnitus by the operation leads him to expect marked or complete relief in approximately 25 per cent of his cases.

He reports on 100 cases of stopple insertion in which operation was done 2 years previously:

Hearing improved and improvement was maintained in 51 per cent.

CRITERIA FOR GROUPING

| | Air Conduction | Bone Conduction Masking | Rinne | Normal and Middle Ear and Patent Eustachian Tubes | Paracusis Willisii | Age |
|---|---|---|---|---|---|---|
| Group I | Not below 80 decibel loss up to 2048 | Not below 20 decibel for 512<br>30 decibel for 1024<br>40 decibel for 2048 | –ve for forks from 256–2048 | Essential | ++<br>++ | Best results 16 to 35, but may operate at any reasonable age |
| Group II | Not below 80 decibel loss up to 1024 | Not below 20 decibel loss for 512<br>35 decibel loss for 1024<br>45 decibel loss for 2048 | –ve all forks from 256 to 1024<br>2048 usually not heard | May have had a former Ch. S.O.M. | ++ | Usually 35–60 |
| Group III | May have 100% deafness at any frequency | Usually 256 and 512 are heard | –ve for 256 and 512 | May or (may not) be present | + or — | Usually elderly though occasionally in early twenties |

Hearing improved and the improvement was lost later in 39 per cent.

Hearing was not improved in 7 per cent.

Hearing became worse in 3 per cent.

The degree of improvement is not specified, nor is the final hearing level attained by the patient mentioned.

An interim report (patient's operated upon less than 2 years previously) on the author's last 450 cases in the past 18 months under the previously mentioned groupings is as follows:

Group 1. Hearing was improved to the practical level and maintained in 86 per cent.

Group 2. Hearing was improved to the practical level in 33 per cent.

Group 3. In 3 cases, no improvement was noted.

In the latter series, the author has not had a case in which the fistula has completely closed as judged by the fistula sign on probing.

The author emphasizes the importance of detailed follow-through records of the operative technique together with standardized audiometric records to all surgeons actively engaged in the fenestration operation. EUGENE L. DERLACKI, M.D.

## NOSE AND SINUSES

**Orbital Complications Resulting from Lesions of the Sinuses.** AUSTIN T. SMITH and JAMES T. SPENCER. *Ann. Otol. Rhinol.*, 1948, 57: 5.

The authors present 12 cases illustrating infections, mucoceles, epidermoid cysts, and osteomas of the paranasal sinuses responsible for complications of the orbit. The intimate anatomical relationship between the sinuses and the orbit allows for ready involvement of the orbital contents by inflammatory and other lesions of the sinuses.

The diagnostic problem involved in the orbital complications depends upon a consideration of the symptomatology as follows:

1. The symptoms of inflammatory changes in the orbit, such as (a) inflammatory edema of the eyelids, (b) subperiosteal abscess, a collection of pus between the bony wall and the periorbita, (c) orbital abscess, (d) orbital cellulitis, and (e) cavernous sinus thrombosis of the anterior or orbital type.

2. The symptoms of disturbances from mechanical causes due to encroachment upon the capacity of the orbit by mucoceles, pyoceles, chronic hyperplastic sinusitis, cysts, and neoplasms, and manifested by displacement and disturbance in the mobility of the globe, injury to the optic nerve, changes in refraction, and disturbance in the drainage of tears.

3. The orbital apex or sphenoid fissure syndrome, a syndrome consisting of ptosis, complete ophthalmoplegia, impaired vision, and pain corresponding to the ophthalmic division of the fifth nerve, which is caused by affection of the vessels and nerves which pass through the superior orbital fissure and the optic foramen.

The authors found in their study that difficulty and delay in diagnosis arose because (1) the sinus infection was not apparent from symptoms or rhinologic examination; (2) a noninflammatory lesion was obscured by inflammatory reaction; (3) in spite of a history of sinus infection, the focus was elsewhere; and (4) lesions of the sinuses such as mucoceles, cysts, or osteomas gave no nasal symptoms and encroached on the orbit so gradually that eye symptoms were not manifest until the involvement became marked.

The authors believe that roentgen examination was the greatest single aid in the diagnosis, but it must be correlated with the clinical evidence.

As for treatment, inflammatory conditions causing orbital infections are most efficaciously treated with penicillin in adequate dosage given parenterally, which largely obviates the previously practiced, customary procedures. As for the lesions which cause disturbances by mechanical means, the authors advocate surgical incision and drainage through the sinuses into the nose in cases of mucocele, pyocele, and hyperplastic lesions, or surgical removal of neoplastic lesions such as osteomas, followed by the establishment of adequate nasal drainage.

In illustrating the problems of diagnosis and therapy, the authors reviewed the case histories of (1) 6 cases of the inflammatory group, (2) 3 cases of mucocele, (3) 1 case of epidermoid cyst of the frontal bone, and (4) 2 cases of osteoma of the frontal and ethmoid sinuses. EUGENE L. DERLACKI, M.D.

## MOUTH

**Oral Conditions with a Background of Systemic Disease.** KURT H. THOMA, DANIEL J. HOLLAND, JR., HOWARD W. WOODBURY, JARREL G. BURROW, and EDWARD L. SLEEPER. *Oral Surg. M. Path.*, 1948, 1: 8.

This article concerns the report of 2 cases of oral disease which represent very dramatic examples of the importance of co-operation between the dental, medical, and surgical services for proper diagnosis and treatment of diseases, the first symptoms of which may occur within the oral cavity. The neglect of a complete physical examination in such cases may cause very embarrassing results.

The first case was that of tumor of the maxilla associated with hypoparathyroidism. This case was that of a 62-year-old farmer who was referred to the dental clinic for treatment of a firm, nontender, asymptomatic swelling of the left side of the face of 3 weeks' duration. This tumor involved the anterior portion of the left alveolar process, and caused the left cheek to bulge. It had increased progressively for 3 weeks. The patient was referred by the dental clinic to the laboratory for blood studies after a biopsy of the lesion, which came back as a "giant-cell epulis."

The presumptive diagnosis of hypoparathyroidism was made at this time from the blood studies. Surgical intervention was discouraged, and the patient was referred to the medical service of the hospital for further study. At that time, the complete medical

history revealed that 4 months prior to admission the patient had noticed swelling of the right maxilla anteriorly, and 3 months previously he had consulted a local physician, who had excised the mass and removed a tooth root. After that, all his teeth were removed. Four weeks previously the patient had a similar swelling of the left maxilla anteriorly, and he again consulted his physician, who believed the swelling to be similar to that on the other side and incised it, obtaining a bloody mucoid material. The completion of the operation was deferred because of the size of the mass. The patient was then referred to the dental clinic.

During the past 4 months the patient had also noticed excessive fatigue, extreme weakness, vomiting, polydipsia, and polyuria. His condition had become progressively worse. Physical examination disclosed a bilateral firm, nontender soft tissue mass in the anterior maxilla. This was associated with a firm, nodular swelling believed to be localized in the left side of the lower neck, probably within the thyroid. The remainder of the physical examination was negative. X-ray examination revealed cystic degeneration of the maxilla, granular appearance of the skull, and other bony decalcifications consistent with a diagnosis of osteitis fibrosis cystica.

It was agreed that surgical exploration of the parathyroids with a presumptive diagnosis of parathyroid adenoma was indicated. Because of the poor physical condition, the operation had to be deferred temporarily, but it was done finally and bore out the clinical impression; a large cystic parathyroid adenoma was extirpated. Closer exploration was not possible because of the condition of the patient. Postoperatively, the patient's course was good except for a kidney complication which was treated by sulfadiazine. He also had several thromboses of the deep veins. However, some time after he had recovered from the complications, he stated that he had not felt so well for years.

This is one example of a case in which local excision of a tumor should not be done unless a complete physical examination and other studies are carried out. It is felt that such studies are not done often enough.

The second case mentioned in this article was a thrombocytopenic purpura associated with bleeding from the gingiva. First a very brief description of the etiology of the platelets in the clotting mechanism of the blood is given. The patient was admitted to the hospital on June 6, 1947, with the chief complaint of back pain and loss of weight. Examination was essentially negative, and a diagnosis of osteitis condensans ilii was made. Laboratory findings on the initial admission were given. The patient returned home following instructions, but she began to have continuous, rather profuse bleeding from the gums. She also developed prolonged abnormal profuse menstrual bleeding.

On admission again on July 5, 1947, a diagnosis of purpura was made. This was confirmed by blood studies as well as physical examination and associated tests. A detailed account of the examination and laboratory tests is included in the report. The oral examination showed profuse bleeding from the gums, which did not respond to any local treatment. On July 9, 1947, a splenectomy was performed. On the first 2 postoperative days the bleeding diminished and at times stopped completely. However, after the third postoperative day she began to bleed again and her condition progressively became worse in spite of blood transfusions and other supportive treatment; she died on August 9, 1947. The autopsy revealed typical pictures of thrombocytopenic purpura.

The second case shows the possibility of a generalized disease with only local symptoms when first seen. The authors intimate that a patient with any type of bleeding that does not quickly resolve with local treatment should have a very complete examination for systemic disease.

The reports of these 2 cases include photographs of the lesions in question, some photomicrographs, and a detailed description of the laboratory work done on these patients. WILLIAM A. AHROON, M.D.

**Gelatin Sponge in the Obliteration of Cavities Resulting from the Excision of Cysts and Tumors of the Jaws.** KURT H. THOMA and EDWARD L. SLEEPER. *Oral Surg. M. Path.*, 1948, 1:24.

The authors briefly discuss the difficulties encountered in the obliteration of large cavities left by the enucleation of cysts of the jaw. The need of packings and the contamination from the mouth are all contributing factors to the breakdown of blood clots which fill the cavities following operation. The problem is not great in small cavities resulting from these cysts, but in large ones the complications are of importance.

The aim in the treatment of large cysts of the jaw is always to remove the entire cystic epithelium and its contents with the exception of the involved roots and dentigerous cysts where normal eruption is likely to take place. If at operation the teeth in this condition are not interfered with, their normal eruption will take place. The authors state that the Partsch operation has its disadvantages because of the postoperative difficulties of taking care of the patient and the fact that usually a depression marks the site of the former cavity. They briefly report the method of space obliteration that has been worked out in various ways by other workers.

Synthetic bone paste has some advantages, particularly in small cavities which, however, usually need no filling material. The difficulties encountered in filling large cavities with bone paste are given.

The authors give a brief description of the use of fibrin foam and gelfoam in filling such large cavities following operation on cysts of the jaw. They briefly give the histological picture concerning the absorption of this filling material and the absorption of fibrous tissue and bone formation. They state that the fate of the gelatin sponge in such large cystic

cavities is probably much the same as that when the sponge is transplanted into soft tissues.

The authors state that before inserting the fibrin foam or gelfoam into the wound, it should be soaked in a solution to make it more pliable and more readily adaptable to the cavity. It will soak in either normal saline solution in which no infection is present, or in a thrombin solution with or without penicillin, according to whether or not there is considerable bleeding and if or not infection is present. The use of it when the cavity is not exposed to oral bacteria presents no problem, but in the authors' experience it has caused very little trouble even if the oral contents has gotten into the wound.

The authors then report in some detail the history, examination, and procedures carried out in 11 cases of large cystic cavities of the jaw in which gelfoam or fibrinfoam was used to pack the cavities following the operation. WILLIAM A. AHROON, M.D.

**Plastic Surgical Repair of Facial Paralysis.** PAUL W. GREELEY. *Arch. Surg.*, 1948, 56: 132.

This article is a brief, general discussion of the present day status of surgery for facial paralysis. The selection of the patient for surgery, the optimum time for operation, and the desirability of neurosurgical consultation are discussed.

Primary nerve suture or nerve graft when sufficient substance has been lost should be done whenever possible. When such procedure is impossible, resort must be had to measures which will support the paralyzed side. Antogenous fascia lata strips may be used purely as support. When combined with muscular attachments, some activation may be obtained. Muscle pedicled flaps utilizing temporal muscle for the corners of the mouth and the eyelids lend animation but not necessarily support and are best used in conjunction with fascial support. Nerve substitution and use of foreign body material such as tantalum are not recommended.

EARL H. KLABUNDE, M.D.

**Surgical Correction of Developmental Deformities of the Mandible.** REED O. DINGMAN. *Plast. Reconstr. Surg.*, 1948, 3: 124.

The first record of the use of a surgical procedure for correction of malrelation of the jaws dates back to 1848. It has been only during the past 50 years, however, that much interest has been shown in the surgical correction of prognathic deformities of the mandible. When one considers the great number of operations proposed for correction of this deformity, and also the various operations in use today, it is obvious that there is lack of uniformity of thought in regard to this problem. It is also evident that there is no one operation without some undesirable features.

Osteotomy is accomplished by transverse division of the ramus of the mandible, and shifting of the body of the bone backwards, where it is held in position during the course of healing.

It is today the most popular of the operative procedures because it is simple to execute, avoids the possibility of injury to the inferior alveolar nerve, it does not entail sacrifice of useful bone, nor does it damage the mandibular arch or teeth. The operation also can be done without contamination with the oral cavity. There are, however, numerous disadvantages, very few of which have been given adequate mention in the literature.

Although excellent results have been obtained in the correction of prognathic deformity by the method of osteotomy, there are many disadvantages to the procedure, and the possibility of failure is great: (1) possibility of lack of control of upper or proximal segment due to muscular action, with separation of fragments and nonunion; (2) nonunion is possible; (3) osteotomy through the neck of the condyle may result in destruction of function of both temporomandibular joints; (4) osteotomy through the neck by the blind passage of a gigli saw has the disadvantage of inability to control the proximal fragment, with the possibility of injury to seventh nerve and internal maxillary artery, and the possibility of throwing the muscles of mastication out of normal alignment; (5) a transverse cut too close to the sigmoid notch offers the possibility of separation of the coronoid from the condyloid process.

The alternate choice of site of operation, to that of cutting through the ramus of the mandible, is section through the body of the mandible or ostectomy. In ostectomy, a previously measured section of bone is removed from the body of the mandible.

The removal of a section of bone from the body of the mandible has numerous advantages. The operative site is more accessible, and the fragments can be more easily controlled and held in position with very great accuracy by means of dental splints fitted to the teeth or to the alveolar ridges of the mandible. In sectioning through the body of the mandible, there is no interference with the muscles of mastication, and there is no possibility of an open bite relationship developing after the anterior fragment has been placed accurately in position. The chief objections to this procedure are the sacrifice of functional teeth in many instances, and destruction of normal bone at the site of ostectomy.

The advantages of osteotomy are: (1) osteotomy affords the greatest possibility of avoiding the mandibular nerve and associated structures; (2) it is easy to execute; (3) it avoids the extraction of normal teeth and the sacrifice of useful bony structure; and (4) also avoids the possibility of oral contamination.

The author advocates a two stage method of ostectomy, a modification of the method introduced by Harsha in 1912, by which a section of bone is removed from the body of the mandible without interfering with the inferior alveolar nerve and associated structures. The procedure consists of removal of a section of bone from the body of the mandible, without cutting the inferior alveolar nerve or compounding the wound intraorally.

The first stage is a relatively minor procedure and the patient is treated under local anesthesia as an

out-patient. If the area is edentulous, this consists of making an incision along the crest of the alveolar ridge and gingival margins of the adjacent teeth, and elevating the mucoperiosteum from the buccal and lingual surfaces in the immediate vicinity. If a tooth is removed at the same time, the mucoperiosteum is elevated from the buccal and lingual plates opposite the area of extraction. Using a bone drill, the bone is cut downward and transversely across the alveolar ridge. In order to avoid injury to the inferior alveolar nerve, a safe distance is maintained between the depth of the bone incision and the nerve. The bone is not removed at this time. The soft tissue is returned to position and carefully sutured in place over the ridge.

During the second stage, incisions are made bilaterally parallel and 1 cm. below the inferior border of the mandible in the selected area. Careful dissection should be done to avoid the mandibular branch of the facial nerve. Through this incision the lower border of the body of the bone is exposed. By carefully retracting the periosteum a slight amount, medially and laterally, the cuts in the bone from the previous intraoral stage are readily identified. By the use of bone drills, these cuts are extended through the cortical plate of bone down to the lower border of the mandible. A horizontal cut through the cortical plate on the lateral surface about 1 cm. above the inferior border and between the two vertical cuts permits the insertion of a small chisel. A twisting motion fractures off the lower border of the bone, exposing the nerve. Great care is exercised in order to avoid the mandibular nerve, which is carefully exposed by removal of the surrounding medullary bone. After identification of the nerve and before the bone is completely excised, holes are drilled with a small bone drill from the buccal to the lingual nerve just above the inferior border of the bone on both sides of the ostectomy site. These small holes provide pathways for passage of 22 gauge stainless steel or tantalum wire, which is used to approximate the bone fragments. The medullary portion of the bone is then countersunk or hollowed out in the immediate vicinity of the nerve to permit a resting place for the excess of nerve when the bone fragments are approximated. After excision of the bone up to the nerve, it is quite simple to remove the entire block of bone above the nerve without getting into the oral cavity. The bone should be wired securely to prevent slipping or upward riding of the posterior fragment due to action of the closing muscles of mastication. The wires are twisted tightly and cut short.

Retrusion deformities in which the mandibular teeth are within the normal limits of occlusion with the maxillary teeth may be satisfactorily corrected by bone or cartilage implants to the anterior surface of the mandible. In marked retrusion deformities with malocclusion, implants of this kind fall short of producing the ideal result.

A procedure designed to advance the bone in order to improve the occlusal relationships as well as the contour of the chin seems advisable in certain deformities.

The author has employed a two stage operative procedure for correction of retrusion deformities of the mandible in 2 cases. The operation is done through the body of the mandible and is accomplished in such a way that the inferior alveolar nerve and its associated structures are not destroyed. The operation being done through the body of the mandible offers the distinct advantage (over operations done through the ramus) of noninterference with the muscles of mastication. LOUIS T. BYARS, M.D.

**Osteomyelitis of the Jaws.** KURT H. THOMA, DANIEL J. HOLLAND, JR., HOWARD W. WOODBURY, JARREL G. BURROW, and EDWARD L. SLEEPER. *Oral. Surg. M. Path.*, 1948, 1: 76.

The authors state that the treatment of bone infection that was developed by them has continued to give good results. This treatment consists in combining the use of antibiotics appropriate for the infecting organism with adequate surgery to remove dead and infected bone, followed by careful débridement of the area and saucerization of the bone defect. The antibiotics are given intramuscularly, but are also supplemented by local instillation directly into the involved areas.

The authors give in some detail the case histories of several cases in which this technique was carried out with satisfactory results. These cases were: (1) acute osteomyelitis of the mandible associated with infected wen, (2) subacute osteomyelitis of the ascending ramus, (3) osteomyelitis of the mandible following tooth extraction, (4) chronic osteomyelitis of the mandible following accident, and (5) irradiation necrosis of the maxilla.

WILLIAM A. AHROON, M.D.

## NECK

**Thyroiditis.** GEORGE CRILE, JR., *Ann. Surg.*, 1948, 127: 640.

This study, concerned with the 3 main clinical types of thyroiditis, consists of 27 cases of subacute thyroiditis, 14 cases of struma lymphomatosa, and 11 cases of Riedel's struma. Each of these conditions is a distinct entity of unknown etiology, and probably unrelated to the other two. All of them occur predominantly in the female and, as a rule, after the fourth decade.

Subacute thyroiditis is much more common than the others. It may be the consequence of a virus infection, and is considered the same disease as pseudotuberculous or giant-cell thyroiditis. It is characterized by a diffuse subacute inflammation with numerous foreign-body giant cells, probably related to the colloid in the degenerating follicles. A firm, symmetrical enlargement of the gland occurs but this is seldom pronounced.

In contrast to the other types, the onset is usually sudden, pain and thyroid tenderness is marked, and there is evidence of a systemic toxic reaction, but

true hyperthyroidism does not appear. Easily recognized, subacute thyroiditis tends to subside spontaneously without significant alteration of the thyroid function. Irradiation brings about a prompt and dramatic response and obviates the need for thyroidectomy. Thiouracil may be beneficial.

Struma lymphomatosa, also known as Hashimoto's thyroiditis, is a progressive disease which appears to be related to deficiency disorders. Histologically, one notes an extensive acidophilic degeneration of the epithelial elements with replacement by fibrous and, notably, lymphoid tissue containing well developed germinal centers. The process is diffuse and, while the entire gland increases markedly in size, its shape becomes somewhat asymmetrical.

Struma lymphomatosa is insidious in onset and usually asymptomatic except for the hypothyroidism, or at least a peculiar hypometabolism, which does not always respond specifically to glandular extract. Occasionally, when the trachea is encircled, symptoms of obstruction appear. In the rare case in which the diagnosis is made preoperatively, irradiation may prove beneficial. A very conservative resection of both lobes is recommended when the disease is recognized at operation, as the morbidity is high following radical resection.

Riedel's struma, also known as woody or ligneous thyroiditis, is the least common of the 3 conditions. The typically concentric laminations of fibrous tissue surrounding degenerating adenomas suggest that some change in the adenoma may be responsible for the reaction. In contrast to the other conditions, the inflammatory process is limited, as a rule, to one lobe and is productive of a very large bulky, stone-hard tumor which invariably extends beyond the confines of the capsule to infiltrate and involve the trachea and adjacent structures. This process is slow but progressive and may be indistinguishable from advanced carcinoma preoperatively.

It commences without pain, tenderness, or systemic symptoms. However, pressure symptoms, often with tracheal obstruction, are present in over one-half of the cases. Irradiation is of little or no value, and surgery is apt to be difficult. It is unwise, unnecessary, and often dangerous to attempt to remove the entire lobe. Removal of the core containing the adenoma, when possible, appears to relieve the symptoms and promote subsidence of the fibrous proliferation. DAVID H. LYNN, M.D.

**A Contribution to the Knowledge of the Frequency of Thyrotoxicosis in Finland during the Years 1935–1946.** O. BISTRÖM. *Acta med. scand.*, 1948, 130: 199.

The author examined the records of the Helsingfors City Hospital and the General Hospital of Helsingfors for the years 1935 to 1946, inclusive. Townspeople were treated in the former hospital and country people in the latter. Since both institutions are associated with the University, the diagnoses were accepted as reliable.

Of 2,114 thyrotoxic patients, only 241 (11 per cent) were males. Most of the patients were in the fourth decade, but there were 2 in the first decade and 15 in the eighth or a later decade. In 1935 there was a total of 155 cases of this disease in the two hospitals.

In the succeeding years, ending with 1946, the numbers were 217, 203, 188, 255 (1939), 206, 234, 126, 162, 99, 174, and 185. The peak years were 1936 (217 cases), 1939 (255 cases), and 1941 (234 cases). The low years were 1942 (126 cases) and 1944 (99 cases). The curve representing these figures was very much the same as that in the graphs for (a) the number of thyrotoxic patients per 1,000 total patients in the hospitals for each year, (b) the severe cases, and (c) the incidence of exophthalmos. No great difference was noted between the curves for the townspeople and the rural people.

The author correlates the graphs with various factors, particularly with change in psychological tension and with food supply. He believes that the most likely factor influencing incidence and severity is the food supply. At least, the smallest number of cases occurred during the period of greatest scarcity of food, and the greatest number at times of greatest availability of foods, especially protein and fat.

CLINTON H. THIENES, M.D.

**Subglottic Cylindroma, with Special Reference to Its Clinical Course.** DAVID IDE and HERBERT L. CAHN. *Laryngoscope*, 1948, 58: 328.

The authors emphasize that every case of clinical asthma should be studied by endoscopy for tracheobronchial pathology. Primary malignant disease of the trachea is rare. Cylindromas are tumors in which hyaline strands or balls are interspersed with strands of flattened cells. They are generally benign but may metastasize, and they are probably epithelial in origin, arising from the glands or surface epithelium of the mouth and nasopharnyx.

A case is reported of a 52-year-old white male, whose complaints were a choking sensation, bloody expectoration, dyspnea, and dysphagia of 2 years' duration. He was in great distress with a wheezing respiration. A previous diagnosis of asthmas had been made. Laryngoscopy revealed a subglottic mass from which biopsy material was obtained. The pathological report described only chronic inflammation. The patient's condition improved, but symptoms recurred in a month, at which time surgery, consisting in tracheotomy and removal of the subglottic mass with fulguration of its base, was performed. The pathologic diagnosis was cylindroma. The tracheotomy tube was removed on the third postoperative day and the patient made an uneventful recovery and obtained complete relief of all symptoms.

There is diversity of opinion as to whether surgery or radiotherapy should be advised in the treatment of these tumors. In this case surgery proved a safe and remedial procedure.

S. LLOYD TEITELMAN, M.D.

**The Use of Contact Therapy in the Treatment of Carcinoma of the Larynx.** BRUCE PROCTOR, JAMES E. LOFSTROM, and CARL E. NURNBERGER. *Laryngoscope*, 1948, 58: 225.

Since April, 1946 the authors have treated 9 patients with carcinoma of the larynx by the technique of laryngofissure and contact x-ray therapy. Eight of the patients were of the type usually treated by laryngectomy or massive external irradiation, but they either had refused such irradiation or had complications which were contraindications for the more radical treatment. During the 21 months of the study, only one recurrence occurred (at 4.5 months). The dose varied from 5,000 to 12,000 roentgens.

An elaborate description of the radiation technique, with dosage charts, is given in this 18 page report. CLINTON H. THIENES, M.D.

**Extirpation en Bloc of the Larynx and of the Lateral Cervical Nodes on One Side** (Asportazione in blocco della laringe e dei gangli laterocervicali monolaterali.) VITTORINO PRICOLO. *Chirurgia*, 1947, 2: 451.

The author describes his procedure in the surgical treatment of cancer of the larynx and its metastases. He removes the larynx, and the cervical lymph nodes on one side en bloc.

A basal preanesthetic is given, followed by local infiltration of both the superficial and deep tissues, the larynx, and the cervical plexus.

A "U" incision is made through the skin and subcutaneous tissue, extending from the mastoid on one side, along the posterior border of the sternocleidomastoid muscle, above the clavicle, and to the opposite mastoid. After the posterior margin of the sternocleidomastoid is freed, and the sheath of the trapezius is opened, the sternocleidomastoid muscle is sectioned at its insertion to expose the scalenus muscles. All adipose tissue is removed from the supraclavicular space. The omohyoid, the transverse cervical vessels, and some rami of the cervical plexus are sectioned after the internal jugular vein is ligated at the base of the skull and at the clavicle. Attention is paid to the facial and hypoglossal nerves when the posterior belly of the digastric and stylohyoid muscles is detached. The spinal nerve accompanying the internal jugular vein was sectioned, as were the superior laryngeal nerve and vessels. The posterior border of the thyroid cartilage is freed and the hyoid bone is separated from the suprahyoid musculature, always from the back to the front. The posterior margin of the thyroid gland is liberated from the thyroid cartilage without opening of the perichondrium, but the constrictor fibers are separated.

When the larynx has been isolated by this procedure, an endotracheal and an endolaryngeal anesthetic block is effected. The trachea is sectioned below the cricoid cartilage, the dissection starting from below, and the pharynx is thereby opened as far as the base of the tongue. The larynx is excised en masse with the hyoid bone, and with the nodes of the jugulocarotid chain on one side of the neck. The pharyngeal wound is closed with two layers of continuous catgut No. 00, with care to avoid entering the mucosa with the suture. The author then sutures the trachea to the skin and places a gauze drain on the side of the removed internal jugular vein, and a rubber drain on the opposite side.

In 2 patients in whom the cancer had metastasized to the cervical nodes on both sides, the operation was done in two stages. Extirpation of the larynx en bloc with the lymph nodes and internal jugular vein was done first on one side of the neck, followed after one month by the second operation during which the lymph nodes and the internal jugular vein on the opposite side of the neck were removed. The histological examination showed metastases in both sets of nodes. After 3 years of observation no ill effects were seen in these patients.

Fifteen patients have been operated upon by this technique without a mortality or complication, either operative or postoperative. No fistulas formed.

ARTHUR F. CIPOLLA, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## SPINAL CORD AND ITS COVERINGS

**Paraplegia in Cervical Spine Injuries.** ROLAND BARNES. *J. Bone Surg.*, 1948, 30B: 234.

"One of the most puzzling features of injuries of the cervical spine is the lack of correlation between the degree of vertebral displacement and the severity of the spinal-cord lesion." The author is convinced that spinal-cord injury can occur in the absence of any vertebral dislocation. Twenty-two cervical spine injuries are classified into flexion and hyperextension types. The former group is further subdivided into: (1) anterior dislocation, (2) acute retropulsion of an intervertebral disc, and (3) crush fractures of a vertebral body. The hyperextension types are (1) posterior dislocation, and (2) injury to an arthritic spine.

Cord damage in the nine cervical dislocations was due to a combination of pressure on the dorsal surface by dislocated neural arches and simultaneous compression of the ventral surface of the cord by a retropulsed disc. Skeletal traction was the treatment of choice.

Three cases of acute retropulsion of the intervertebral disc are presented, only one of which was actually visualized at operation; the 2 other patients were merely treated by skeletal traction and recovered partially from their paralysis. Because of the narrowed intervertebral disc space and the absence of x-ray evidence of bony injury, retropulsion of the disc was inferred. Treatment varied with the case. "If the disc was not regarded as degenerated before injury," traction was used to restore the disc height. If paralysis was incomplete and the Queckenstedt test was normal, the cord was regarded as being under severe compression, and a trial of skeletal traction was justified. If there was no recovery from paraplegia within a few days laminectomy was considered, even though the Queckenstedt test was normal.

In 4 cases there was a marked crush fracture of the vertebrae with destruction of the cord of varying severity. In one of these cases there was compression of the ventral surface of the cord by an extruded disc. Treatment of these injuries was similar to that used for spinal-cord compression due to a retropulsed disc.

There were 6 cases of hyperextension injury to arthritic spines. All of the patients were over 50 years of age and had moderate or severe changes of the spine without roentgenographic evidence of recent vertebral injury. The mechanism of this type of injury is discussed. With hyperextension of the cervical spine there is rupture of the anterior common ligament, avulsion of a small bit of bone from the anterior margin of the upper vertebra, and a tear through the disc. The latter does not extend into the canal. No resistance is offered to further hyperextension, and wider separation of the bodies occurs. After the initial trauma, normal alignment of the vertebrae is restored by spasm of the neck muscles, and there is no apparent distortion noted in the roentgenogram of the spine.

Minor displacements of spurs on the vertebrae may cause concussion of the cord. The author has likewise postulated that a traction injury to the cord may occur, since neurological levels corresponding to several segments above the point where hyperextension has occurred are found. Experimental work performed by the author does not tend to substantiate this theory, but he is not satisfied completely with the methods used. There is no indication for the use of traction in these cases. Neither is immobilization in plaster necessary; this is uncomfortable and often dangerous in the older patients usually found with this condition. Treatment is best accomplished by gentle flexion of the cervical spine, produced by placing a pillow under the head.

RICHARD C. SCHNEIDER, M.D.

**Paraplegia in Hyperextension Cervical Injuries.** ALEXANDER R. TAYLOR and WILLIAM BLACKWOOD. *J. Bone Surg.*, 1948, 30B: 245.

Damage to the cervical part of the spinal cord with paraplegia may occur without x-ray evidence of dislocation or injury of the vertebrae. Several mechanisms have been postulated. One is that the massive prolapse of a disc may cause pressure on the cord; however, the authors state that this lesion can usually be recognized in the roentgenograms by a slight narrowing of the intervertebral space. Another suggested etiology is a hyperflexion dislocation which causes paraplegia with spontaneous reduction; but the authors believe that a flexion of this severity would be sufficient to cause, in addition, a crushing of the vertebrae or dislocation of their facets, and thus be detectable roentgenographically.

Forced hyperextension of the spine without x-ray evidence of displacement is proposed in this article as the usual mechanism of the type of injury described. Two cases are presented to illustrate this point. It is thought that this factor was overlooked for so long because surgeons have been indoctrinated with the belief that the anterior ligaments are so strong they will not rupture, and the assumption that if there is severe hyperextension of the cervical spine the atlas and axis will fracture through the arches at the base of the odontoid.

The differential diagnosis lies mainly between acute prolapse of the intervertebral disc and hyperextension injury with immediate reduction. Very minor changes in the roentgenogram, such as narrowing of the intervertebral disc space or the suspicion of wedging of the vertebrae suggest a ruptured disc. Myelography should demonstrate a disc of sufficient size to cause damage to the cord. On the

other hand, an older patient with a kyphotic deformity or a patient with a history of injury to the face or forehead suggests a hyperextension injury. Tearing of a small chip of bone from the anterior portion of the vertebral body suggests rupture of the anterior ligament and, if myelography is negative, the diagnosis of hyperextension injury is clinched. The authors are skeptical of the occurrence of "recoil" of the disc with spontaneous reduction in hyperflexion injuries. They believe that the annulus and the posterior longitudinal ligaments will not stretch sufficiently to cause contusion to the cord without actual rupture.

The diagnosis of hyperextension injuries is important because, if the customary treatment of extension is applied to this type of injury, redislocation of the spine may occur with narrowing of the spinal canal. The patient with this type of injury should be treated in a shell or immobilized between sandbags with his head in a neutral or slightly flexed position. RICHARD C. SCHNEIDER, M.D.

## PERIPHERAL NERVES

**Pressure at the Cervicobrachial Junction.** E. D. TELFORD and S. MOTTERSHEAD. *J. Bone Surg.*, 1948, 30B: 249.

The causes of pressure on the neurovascular bundle at the cervicobrachial junction are many and varied. In a careful study the authors present 122 cases in which the patients were operated upon for symptoms referable to pressure on this region. There were 105 uncomplicated cases in which the symptoms in the upper extremity were classified as being due to pressure by fibrous bands, from abnormal disposition of the scalene muscles, by cancellous osteomas, deformed thoracic outlets due to pressure of the clavicle on the first rib, and, lastly, by cervical ribs. Seventy of these cases, or 66 per cent, were due to cervical ribs, while in 5 cases, or 4.7 per cent, there was no obvious cause found. Seventeen patients had complications which overshadowed the customary symptoms. Of these, 15 had extensive arterial thromboses and well developed cervical ribs. The 2 other patients suffered from hyperhidrosis which was severe enough to interfere with their work and one of these also had a cervical rib.

Three controversial points concerning pressure on the neurovascular bundle are discussed. In reviewing the scalenus anterior syndrome, the authors point out that in their experience there are many people who do not get relief from anterior scalenotomy. Those who benefit from the operation fall into a group in which the action of the anterior scalene muscle is passive and mechanical, i.e., fibrous bands actually do occur, wide insertions of the muscle on the cervical rib are present, or overlapping with the scalenus medius occurs. The active action of the scalenus anterior muscle attributed to spasm, disease, or injury is discounted completely. The authors do not feel that there is justification for the diagnosis of "scalenus anterior syndrome" and operation directed at sectioning of the anterior scalene muscle alone.

As to the costoclavicular syndrome, conclusions were formed on the basis of extensive clinical studies on 120 medical students and more than 50 careful cadaver dissections. If there is a normal relationship between the clavicle and the first rib there can be no compression of the neurovascular bundle against the rib. However, if this space is narrowed either by a large cervical or abnormal first thoracic rib, then any retraction and abduction of the shoulder may lead to pressure symptoms. Depression of the clavicle in the normal individual causes none of these symptoms because the further the shoulder is depressed the wider is the costoclavicular span.

Arterial thrombosis, a serious complication of cervical rib, is carefully reviewed. The authors believe that thrombosis may occur as a result of pressure which causes constant irritation of the sympathetic fibers of the lowest trunk of the brachial plexus. Prolonged arterial spasm occurs secondarily. However, in some of the cases a gross abnormality of the vessel wall which could not be attributed to this cause was noted at operation. This change was explained by paralysis of the vasomotor nerves which degenerate as a result of repeated contusions. Secondary dilatation and stretching of the denervated middle coat of the vessel extends distal to the site of the injury, just as far as the point at which the next nerve relay enters. No doubt, after prolonged trauma or stretching of this aneurysmal dilatation, thrombosis takes place.

In conclusion, it was emphasized that operations for the relief of symptoms due to pressure on the neurovascular bundle of the upper extremity should not be carried out with the thought of doing one preconceived procedure, but should be done in the nature of an exploration with wide enough exposure for adequate investigation of the entire region.

RICHARD C. SCHNEIDER, M.D.

**The Problem of Malignant Hypertension and Its Treatment by Splanchnic Resection.** MAX M. PEET and EMIL M. ISBERG. *Ann. Int. M.*, 1948, 28: 755.

Despite an occasional report in the medical literature listing malignant hypertension as a contraindication to sympathectomy, the authors refute this statement and present a series of 143 patients with malignant hypertension who have been treated by Peet's supradiaphragmatic sympathectomy. The diagnosis of malignant hypertension is based upon the following criteria: (1) a rapidly progressive, deteriorating clinical course of recent onset; (2) severe neuroretinitis with a definite papilledema of one diopter or more; (3) high diastolic blood pressure and (4) evidences of constitutional involvement.

The operative procedure was a one-stage resection of all of the splanchnic nerves and also of the eighth through the twelfth thoracic sympathetic ganglia. Although in the earlier operations only the three lower dorsal ganglia were removed, there was no

separation of the cases in which the less extensive procedure alone was performed. The operative mortality was 10 per cent.

The patients in this series were operated upon during the period between 1933 and 1941. The ages varied from 14 years to 57 years of age. The greater number of patients, however, were in the fifth decade. Sixty-two per cent of the patients were males. The three most common complaints were headache, visual disturbances, and dyspnea.

A 5 year study of the 143 patients who survived revealed that 31 of the patients, or 21.6 per cent, survived for at least 5 years; 23 patients, or 17 per cent, lived from 5 to 12 years after surgery. In comparison with similar series of patients who had had medical treatment only, especially the Keith-Wagner-Barker series and the Page series, these results may be considered excellent. A study of 25 cases by Flaxman, however, revealed a 5 year survival rate of 34 per cent, under medical management. A re-evaluation of 21 patients who survived for 5 years or more revealed that 4 were maintaining a completely normal blood pressure. In 7 patients the blood pressure was reduced by at least 80 mm. or more systolic, and 25 mm. diastolic pressure. In 6 cases there was a significant reduction of 48 mm. systolic and 15 mm. of diastolic pressure, whereas there was no significant change in 5 cases. In 20 patients with preoperative headaches, 10 had complete relief and 9 were definitely improved. Of 14 patients with visual disturbances, all but 1 had noted definite improvement.

The preoperative complaints of anginal seizures, weight loss, and muscle pain were apparently very ominous, for none of the patients with these complaints had survived 5 years. Eleven out of the 13 patients without evidence of cardiac involvement prior to operation were still living 5 to 12 years after surgery. Two of 16 patients with congestive heart failure before surgery survived for a period of 5 years. Previous episodes of cerebrovascular disease were apparently of little importance, for 6 of the patients who had had previous cerebral accidents were still living and had had no recurrence.

JACK I. WOOLF, M.D.

## MISCELLANEOUS

**Recklinghausen's Neurofibromatosis Associated with Intrathoracic Meningocele.** C. STUART WELCH, ALICE ETTINGER, AND PAUL L. HECHT. *N. England J. M.*, 1948, 238: 622.

The authors report a case of neurofibromatosis in a patient who showed roentgenological evidence of an intrathoracic tumor with marked erosion of the lateral and anterior surfaces of the fifth, sixth, and seventh thoracic vertebrae. Examination revealed a kyphoscoliosis in the midthoracic region but no neurological signs. A transthoracic operation showed the tumor to be a meningocele.

The authors discuss 3 previously reported cases of intrathoracic meningocele, 2 of which occurred in patients with Recklinghausen's neurofibromatosis. They suggest myelographic studies as an aid in differential diagnosis. GEORGE PERRET, M.D.

**Sacrococcygeal Chordoma.** FERNANDO GENTIL and BRADLEY L. COLEY. *Ann. Surg.*, 1948, 127: 432.

This study is based on 7 cases of sacrococcygeal chordoma observed and treated at the Memorial Hospital, New York, during the period from 1930 to 1943, and 128 instances previously reported.

Chordoma is a specific tumor arising from remnants of the primitive notochord. It is characterized by slow inexorable growth, a tendency to invade and destroy bone by direct extension, local recurrence after surgical excision, and slight or negligible regression following radiation. Occasionally, distant lymph node and visceral metastases occur.

Virchow first called attention to chordoma in 1856 when he described small tumorlike cartilaginous masses at the spheno-occipital synchondrosis and termed the condition ecchordosis physaliphora. The term chordoma was introduced 2 years later by Muller; Ribbert in 1894 first established the correct nature of this neoplasm and described 5 cases of his own.

Although chordomas may occur at any age, they are usually encountered during the fifth decade, with a range of from 3 months to 78 years. They are slightly more common in males, a difference difficult to evaluate.

The bulk of evidence indicates that these tumors arise from primitive fibroblastic cells of the notochord. Of all the types of chordoma, 60 per cent were sacrococcygeal, 30 per cent spheno-occipital, and 10 per cent were evenly distributed in the cervical, thoracic, and lumbar regions. The predilection of chordoma for the sacrococcygeal area has never been satisfactorily explained.

Grossly, these tumors are bulky, encapsulated, lubulated, cystic, and purplish red. Cut sections reveal areas of homogeneous and translucent tissue with irregular cavities filled with abundant thin mucin. The microscopic appearance is characteristic and consists of large cells resembling bladder epithelium (physaliferous cells) which contain intracellular and extracellular mucin. These cells are arranged in cords, lobules, or a solid epithelial pattern. Sometimes a syncytial vacuolated arrangement is present. In the malignant types, mitotic figures, cellular pleomorphism, hyperchromatic nuceli, and multinucleated giant cells are found. The tumor is of low grade malignancy, widespread metastases being found in about 10 per cent of the cases.

Symptoms are due to location of the growth and are dependent on expansion and destruction of the adjacent bone. The average duration of symptoms is 20 months before the patient consults a physician. Pain is the earliest and most frequent symptom, causing the complaint of anal and rectal distress. Fecal and urinary disturbances may occur as the tumor invades these regions. With involvement of the posterior nerve roots, sensory disturbances in the lower portions of the body commence. In far advanced cases the picture is that of intractable pain,

paraplegia, and incontinence. The sacrum is particularly liable to destruction.

The most constant physical finding is a mass, the exact location depending on the direction of tumor growth. The hollow of the sacrum should always be carefully palpated. Widespread metastases occur, though rarely, to the lungs, liver, and peripheral lymph nodes.

Sacral chordoma is strongly suggested by a bulky mass externally or in the hollow of the sacrum together with roentgenologic evidence of adjacent bony destruction. Additional evidence is involvement of the pelvic viscera and the absence of overlying skin or subcutaneous tissue invasion.

Differential diagnosis includes chondrosarcoma of the sacrum, tuberculosis of the sacrum, tumors of the female pelvic organs, tumors of the spinal cord, tumors of the sacral soft parts, sacrococcygeal teratoma, and carcinoma of the rectum.

The roentgenographic findings as concluded in the extensive study of Hsieh and Hsieh are expansion, rarefaction or destruction, trabeculation, and calcification.

The final diagnosis is always dependent on histological examination, and aspiration biopsy is recommended. A correct diagnosis was made by this method in 6 of the 7 new cases reported here.

Since these tumors show slight, if any, response to radiation therapy and complete extirpation of the tumor is not feasible, management is chiefly for partial control and palliation. Spinothalamic tractotomy is recommended for the control of pain. A surgical procedure consisting of colostomy, ureteroenterostomy, and tumor excision has been considered, but appears unduly radical at present. Repeated surgical excisions are advised.

Since sacral chordomas are characteristically slow-growing, numerous recurrences follow repeated excisions with massive invasion of the pelvis in late stages of the disease. Occasionally a single surgical extirpation results in control. Among the 128 reported cases, metastases occurred in 15, the most frequent sites being the regional and peripheral lymph nodes, lungs, liver, and skin, respectively. The spheno-occipital type, in striking contrast, almost never metastasizes.

C. Frederick Kittle, M.D.

**Some Observations on the Neurogenic Bladder.** Willet F. Whitmore, Jr., and Luis M. Isales. *N. York State J. M.*, 1948, 48: 869.

Based on their observations of 90 patients with spinal cord injury seen in a Veterans' Administration Hospital, the authors classified the "neurogenic bladder" in each instance according to the following grouping, the numbers of patients of each type being given:

1. Normal, 2
2. Uninhibited reflex, 5
3. Reflex, normal, 48, and reflex, hypertonic, 7
4. Autonomous, 28
5. Atonic, 0.

The detailed definition of each type is given.

Ten per cent of the patients had cervical lesions; 61.1 per cent, thoracic lesions; and 28.9, cauda equina lesions. Both complete and incomplete cord lesions were included.

Among other observations, it was noted that 45.6 per cent of the patients developed satisfactory bladder function, while in 54.4 per cent it was considered unsatisfactory. There was a very gratifying result in general from the use of transurethral resection of the vesical neck. The authors also noted that in their patients suprapubic cystostomy "is deleterious to the ultimate development of satisfactory bladder function."

John Martin, M.D.

# SURGERY OF THE THORAX

## TRACHEA, LUNGS, AND PLEURA

**Cancer of the Lung. Interval and Late Results of Operation in Relation to Topography and Gross Pathology.** HAROLD NEUHOF and ARTHUR H. AUFSES. *J. Thorac. Surg.*, 1948, 17: 297.

Fifty-two consecutive patients surviving operation for lung cancer during the 10 year period from 1935 to 1945 at the Mount Sinai Hospital, New York, are divided into three "topographic" groups and show the following:

Group I (21 cases) consisted of the main and branch bronchus cancers. Twenty patients were treated by pneumonectomy; 7 (33%) now survive.

Group II (18 cases) consisted of circumscribed cancers which appear encapsulated grossly. Six patients were treated by pneumonectomy with survival of 50 per cent, and 12 were treated by lobectomy with survival of 33 per cent.

Group III (13 cases) consisted of peripherally invasive cancers. Twelve patients were treated by lobectomy with survival of 23 per cent.

The authors state that (1) topographic classification should be used as a basis for operability; (2) lobectomy "has its indications in the surgery of pulmonary carcinoma"; and (3) prognosis based on microscopic features cannot be made with any assurance.

The data presented do not permit an analysis of these conclusions. FRANK B. QUEEN, M.D.

## HEART AND PERICARDIUM

**Coarctation and Aneurysm of the Aorta.** HARRIS B. SHUMACKER, JR. *Ann. Surg.*, 1948, 127: 655.

The author reports the case of an 8½-year-old boy with coarctation of the aorta associated with an aortic aneurysm distal to the stenosis which was treated successfully by excision of the involved segment and repair by end-to-end suture of the divided aorta.

The child was hospitalized because of a cardiac murmur, recurrent attacks of otitis media, and a bacteriemia with blood cultures positive for the pneumococcus type VII. He presented findings typical of coarctation of the aorta, and a barium swallow revealed an indentation in the esophagus in the region of the aortic arch. He was thought possibly to have bacterial aortitis and was treated with penicillin and sulfadiazine with prompt subsidence of the signs and symptoms of bacteriemia and infection. The patient was then operated upon.

Operation was carried out through the bed of the fifth rib posteriorly. A coarctation of the aorta was found in the usual location and, in addition, a saccular aneurysm about twice the diameter of the aorta itself, the mouth of which arose immediately distal to the coarctation on the right lateral wall of the aorta (Fig. 1), was noted. The aneurysm and coarcted segment were excised between special clamps as a single specimen, and end-to-end suture of the divided aorta was accomplished by means of a continuous everting mattress suture of number 5 Deknatel. The patient made an uneventful recovery and when seen 2 months after operation was very well and had a brachial blood pressure of 106/70, as compared with a preoperative reading of 140/70. Pulsations in the vessels of the lower extremities were normal, but had been absent preoperatively.

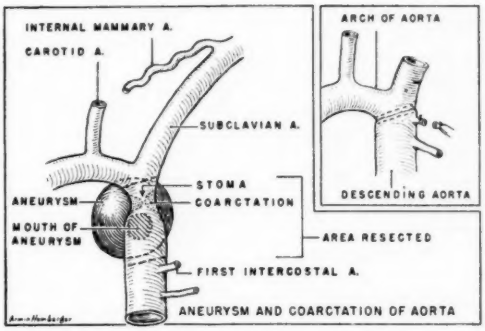


Fig. 1. (Shumacker). Diagrammatic sketch of the condition found at operation. The condition following excision of the aneurysm and coarcted portion of the aorta is shown in the insert.

The aneurysmal sac was lined with platelets and fibrin but contained no demonstrable organisms, a microscopic picture not incompatible with infected vegetations rendered sterile by chemotherapy. The exact origin of the aneurysm could not be determined. Possible factors in general are atheromatosis, degeneration of the elastic tissue of the aortic wall, traction by the ligamentum arteriosum, previous bacterial aortitis with mycotic aneurysm development, and dilatation due to collateral return through aortic intercostals. Dilatation and aneurysm of the aorta may occur either proximal or distal to a coarctation, as pointed out by Abbott, and by Reifenstein, Levine, and Gross in their respective autopsy studies in cases of coarctation of the aorta. Approximately 20 per cent of the deaths in coarctation occur from rupture of the aorta and another 20 per cent occur as a result of bacterial endocarditis or aortitis.

As far as can be ascertained the case reported here is the only recorded one in which an aortic aneurysm was excised and end-to-end suture was done, although Alexander and Byron reported excision of a thoracic aortic aneurysm with ligation of the aortic ends. However, numerous cases of excision of coarcted aortic segments with end-to-end suture have been reported by Gross, Crafoord and Nylin, and others.

The feasibility of excision of aortic aneurysms is based on the location of the aneurysm and the collateral circulation which is present. It is unlikely that aneurysms of the ascending aorta, aortic arch, or the first portion of the abdominal aorta supplying important visceral vessels can be excised successfully, whereas short segments of the descending thoracic aorta and the distal abdominal aorta may possibly be resected and continuity restored provided methods of increasing the collateral circulation become available. The use of vein transplants to bridge aortic defects is suggested. JESSE E. THOMPSON, M.D.

**Primary Vascular Tumors of the Pericardium.** MORRIS GREENBERG AND ALFRED ANGRIST. *Am. Heart J.*, 1948, 35: 623.

Primary pericardial tumors are distinctly rare and are usually either sarcomas or lipomas.

Vascular pericardial tumors are even more rare. Only 5 of the reported cases can be accepted as true neoplasms. Three of these were cavernous angiomas and 2 malignant angioendotheliomas. The remainder were, in reality, examples either of vascularization in organizing blood clots or of prominent vascular channel formation in granulation tissue.

The authors report 2 cases of true primary vascular pericardial tumors. Case 1 was a small ( 1 cm.) benign cavernous angioma found incidentally in the sulcus between the right and left ventricles in a patient dying of peritonitis following operation for adenocarcinoma of the cecum. Case 2 was an invasive cellular angioendothelioma in a 27 year old male dying of cardiac insufficiency produced by the tumor.

No specific clinical picture for tumors of the pericardium has yet been evolved, because signs and symptoms vary with the location and extent of the tumor and with the presence of hemorrhage, its amount, and rapidity of occurrence. If a previously healthy person shows, without known cause, a rapid evolution of symptoms of decompensation and an enlarged cardiac shadow, a pericardial tumor should be considered. FRANK B. QUEEN, M.D.

## ESOPHAGUS AND MEDIASTINUM

**Treatment of Short Stricture of the Esophagus by Partial Esophagectomy and End-To-End Esophageal Reconstruction.** ROBERT E. GROSS. *Surgery*, 1948, 23: 735.

For many years the standard treatment of congenital and chemical burn esophageal strictures has been dilatation, although recently there have been numerous techniques devised to establish some type of antethoracic esophagus. More recently transthoracic esophagogastrostomy has been employed. Primary end-to-end esophageal anastomosis has been regarded as technically impossible in the past, but during the last 2 years numerous successful attempts have been recorded. This method seems preferable to the more radical transthoracic esophagogastrostomy since fairly normal anatomic reconstruction is effected and since it does not interfere with normal functioning of the stomach.

Certain technical aspects of esophageal resection and anastomosis for stricture deserve consideration:

1. The retropleural approach is advocated in children. This insures a reasonable degree of expansion of the lung and eliminates contamination of the pleural cavity during operation, which gives a maximum of protection should there be any leakage during the esophageal anastomosis. It also provides a direct route for external drainage if suppuration or esophageal leakage should occur postoperatively. In older subjects a transpleural route is preferable.

2. Mobilization of the esophagus is accomplished more easily on the right than on the left side. A right-sided incision will not permit the stomach to be drawn up into the thoracic cavity, but unless it can be definitely determined before operation that an esophagogastrostomy will not be necessary, the left approach should be used.

3. Many different types of incision have been advocated, but in general a long intercostal one is best, provided it is located exactly at the level of the lesion. In older patients in whom the costal cage is less yielding it may be necessary to divide several ribs posteriorly.

4. Since reconstruction of the protective bulkhead between the mediastinum and pleural cavity is important, great care must be taken to preserve the parietal pleura covering the esophagus. The longitudinal opening of this layer should be made anterior to the esophagus so that a broad flap can be raised and sutured over it after anastomosis has been performed.

5. The esophagus must be widely mobilized to accomplish its anastomosis without undue tension. Although its poor vascularity has been commented on extensively in the past, the author states that the entire intrathoracic portion may be freed without subsequent damage if this is necessary for resection and reconstruction.

6. Inspection of the esophagus externally may give little clue to the location of the stenotic lesion. For accurate localization a catheter is inserted by the anesthetist and pushed to the constricted region.

7. The esophageal anastomosis is sutured in two layers with No. 5–0 silk, the outer layer including the muscularis and submucosa, the inner the mucosa. Crushing of the phrenic nerve does not appreciably facilitate the operation.

8. A soft rubber drain is inserted into the mediastinum through a stab wound in the back to provide for any postoperative mediastinal suppuration.

9. A rubber catheter is placed into the pleural cavity routinely to allow suction and insure evacuation of the pleural cavity.

10. The establishment of a gastrostomy is advisable to allow for adequate nutrition and to permit healing of the esophageal anastomosis during the early postoperative period.

The case of a 11-month-old boy with intermittent vomiting since birth is presented. Barium studies and

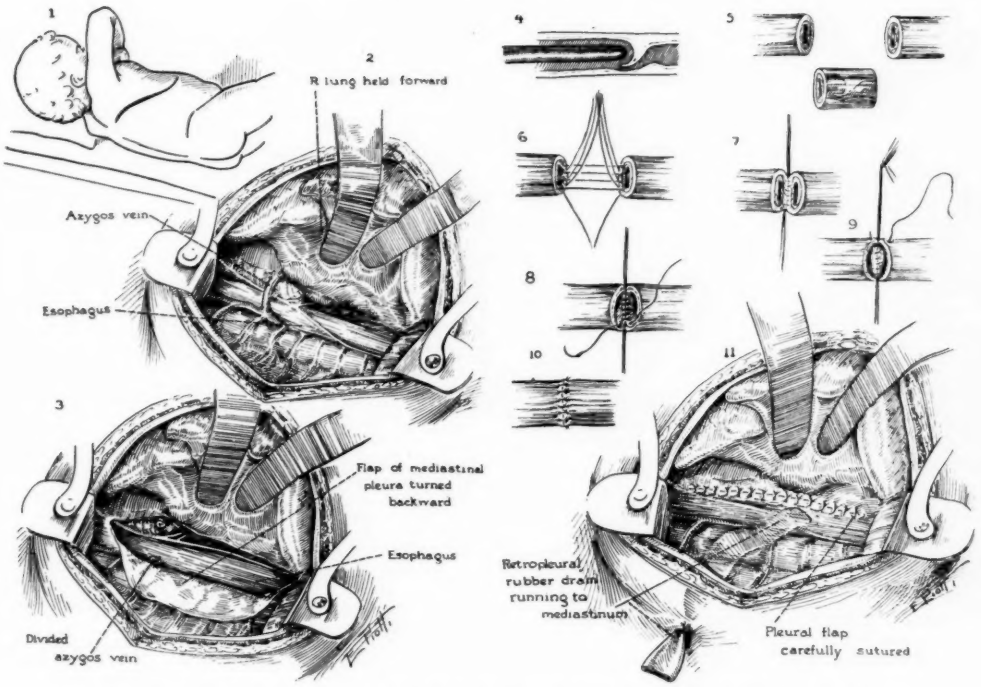


Fig. 1 (Gross). Technique of partial esophagectomy and end-to-end esophageal reconstruction.

esophagoscopy revealed obstruction of the esophagus in its middle portion. Because of marked weight loss and inability to swallow a gastrostomy was done. After a satisfactory state of nutrition was obtained, the esophagus was exposed through a right transpleural approach and a 3 cm. segment of it excised. A primary end-to-end anastomosis was done. Mediastinal and pleural drains were inserted. The postoperative course was uneventful, and, when last seen, the patient could swallow without any difficulty.

C. Frederick Kittle, M.D.

**Congenital Esophageal Atresia and Tracheoesophageal Fistula.** Clayton G. Lyon and Stanley G. Johnson. *J. Thorac. Surg.*, 1948, 17: 162.

Four hundred and sixty-eight cases of esophageal atresia, with or without tracheoesophageal fistula, have been reported. The anomaly has been classified under five main types:

1. The upper esophageal segment terminates in a blind pouch in the upper third, and the lower esophageal segment is represented by the presence of a similar blind pouch, there being no communication with the trachea.

2. The upper esophageal segment communicates with the trachea, and the lower segment is a blind pouch.

3. The upper segment terminates blindly, and the lower segment of the esophagus communicates with the trachea above the carina.

4. Like type 3, but the lower segment communicates with the trachea at the carina or with the right or left main stem bronchi.

5. Both segments communicate with the trachea.

The diagnosis is suggested by increased oral secretions, attacks of cyanosis, or the regurgitation of feedings. Confirmation is obtained by passage of a small catheter into the esophagus, which meets an obstruction in the upper third or fails to enter the stomach. The patient is fluoroscoped while 0.5 or 1 c.c. of lipiodol is introduced through the catheter, which demonstrates the upper segment, with or without its tracheal communication. The inferior level of the upper esophageal segment is elevated during deglutition. After the examination, the lipiodol should be aspirated, as it is easily regurgitated and enters the tracheobronchial tree. Roentgenograms of the chest and abdomen are valuable in determining the condition of the lung fields, the presence of other anomalies, and the presence of gas in the gastrointestinal tract. Gas in the gastrointestinal tract is usually indicative of a fistula.

Four cases are reported in which a transpleural approach, with the patient under intratracheal anes-

thesia, was employed. The operative procedure is given in detail. SAMUEL KAHN, M.D.

**A New Method of Restoring Continuity of the Alimentary Canal in Cases of Congenital Atresia of the Esophagus with Tracheoesophageal Fistula not Treated by Immediate Primary Anastomosis.** RICHARD H. SWEET. *Ann. Surg.*, 1948, 127: 757.

It has been shown by Ladd and others that in many suitable cases of congenital atresia of the esophagus with tracheoesophageal fistula it is possible to close the fistula and perform an immediate primary esophageal anastomosis. In other cases in which primary anastomosis is impossible, cervical esophagostomy and gastrostomy are established as lifesaving measures. In the latter types of patients it is possible to create an external esophagus by various multiple-stage, time-consuming maneuvers, the results of which on the whole have been discouraging. The author describes a new method whereby continuity of the alimentary tract can be restored in this group of patients with previous cervical esophagostomy and gastrostomy, by carrying out an intracervical esophagogastric anastomosis after pulling the stomach up through the chest.

The operation is performed in one stage with three steps. The first step is carried out through a left-sided, eighth-rib, transthoracic approach. The entire stomach to the level of the pylorus is mobilized by cutting the gastrocolic and gastrohepatic ligaments and all vessels except the right gastric and right gastroepiploic, with care to avoid injury to the vascular arcades. The rudimentary distal stump of the esophagus is removed and the gastrostomy opening is closed. The fundus of the stomach is pulled up into the chest posterior to the hilum of the lung and temporarily anchored at the apex. The chest is then closed and the patient turned onto his back. In the second step a vertical incision is made in the left side of the neck, the esophagostomy is mobilized, and the inner portions of the clavicle and first rib are resected. The apex of the thorax is thus entered and the stomach pulled out into the neck. Esophagogastric anastomosis is then carried out with three layers of interrupted silk sutures, as described by the author previously. The final step is the closure of the abdominal-wall portion of the gastrostomy.

The case of a 21-month-old infant treated successfully by this method is reported in detail. At the latest follow-up the patient was eating a diet normal for his age, was gaining weight slowly, and had no obvious physiologic disturbances resulting from the displacement of his stomach through the chest into his neck.

The method was also employed successfully in a 56-year-old man to resect a carcinoma of the esophagus situated behind the manubrium of the sternum, a level too low for a Wookey procedure and too high for transthoracic esophagectomy with high intrathoracic esophagogastric anastomosis.

JESSE E. THOMPSON, M.D.

**Construction of Skin-Tube Esophagus following Surgical Treatment of Tracheoesophageal Fistula.** ROBERT H. IVY, H. R. HAWTHORNE, and JOSEPH A. RITTER. *Plast. Reconstr. Surg.*, 1948, 3: 173.

Various procedures have been proposed for reconstruction of the esophagus following resection for stricture due to caustic burns, malignant disease, or congenital anomalies. Where the gap is sufficiently small, direct anastomosis of the free ends may be possible. In other cases, an epithelium-lined tube of transplanted tissue must be used to restore the continuity. This has been accomplished intrathoracically by carrying a segment of jejunum or a tubed portion of the stomach up to meet the upper stump of the esophagus. Extrathoracic methods comprise the formation of an epithelium-lined tube beneath the skin of the anterior chest wall, connected above with the opening in the neck of the upper stump of the esophagus and with the gastrostomy below.

In 1917, Esser made an anterior thoracic esophagus by tunnelling beneath the skin of the chest and inserting a large rubber tube covered with Thiersch skin grafts. The ends of this epithelium lined tube were later connected with the esophageal opening above and the stomach below.

In 1942, Davis and Stafford reported a case of stenosis of the esophagus following lye burns. After the preliminary operations of gastrostomy and formation of a fistula of the upper stump of the esophagus in the neck, the extrathoracic esophagus was constructed by the formation of a tube lined with inverted skin extending from the upper fistula down toward the gastrostomy opening, a tubed pedicle flap from the side of the body being used for covering. The lower end of this skin-lined tube was later joined to the stomach by a segment of jejunum.

Longmire and Ravitch employed, for the lining of the tube, a loop of jejunum ultimately completely isolated from its mesenteric blood supply. In several stages with successive severance of the vessels supplying it, the segment of jejunum was implanted in the skin tube, so that it finally was completely cut off from its original blood supply. The jejunum-lined skin tube was then transferred to the anterior chest to serve as a channel between the upper part of the esophagus and the stomach.

Ladd reports an extensive experience with esophageal atresia and tracheoesophageal fistula. Of 34 patients, 11 are still living after various operations. In 2 of these, direct anastomosis was possible; in 2, the anterior thoracic esophagus was completed, and in a third patient it was in process of construction; the remaining 6 patients were all doing well and awaiting construction of an anterior thoracic esophagus.

In a more recent paper, published in January, 1947, Ladd and Swenson discuss the subject further. They recommend attempted direct anastomosis if the gap is not more than 2 cm.

In the case reported, the technique described by Ladd was followed as closely as possible. At the first

operation an esophageal pouch was found and a fistula between the distal esophagus and right main bronchus was ligated. The gap in the esophagus was too great for direct anastomosis. The second operation was a gastrostomy. At the third operation the superior mediastinum was entered and the blind end of the esophagus freed and brought out through the chest wall. It was opened 2 days later. The construction of the esophagus was then done in stages, forming a skin lined tube. The procedure consisted of forming two separate skin lined flaps, one attached to the esophagostomy opening and one to the gastrostomy, and later attaching these together. Feeding by mouth was begun right away. A constriction was found at the gastrostomy opening, which was corrected by operation.

From a pediatrician's viewpoint, the operation of choice, when possible, is primary anastomosis. The multiple stage operation with or without a jejunal segment or a free jejunal transplant is a formidable amount of surgery and has psychological implications for the patient. The multiple stage operations require extensive hospitalization with exposure to infection and a tremendous utilization of hospital services.

With all these facts in mind the possibility presents itself of the advisability of performing a primary anastomosis with a thoracic stomach when the segments cannot otherwise be approximated with safety. This operation has been attempted in infants by Singleton and might be considered in suitable cases. LOUIS T. BYARS, M.D.

**Esophageal Hiatal Hernias of the Short Esophagus Type: Etiologic and Therapeutic Considerations.** ARTHUR M. OLSEN AND STUART W. HARRINGTON. *J. Thorac. Surg.*, 1948, 17: 189.

A study was made of 220 patients with short esophagus and a partial thoracic stomach seen at the Mayo Clinic. On the basis of this review, the following conclusions were drawn and observations made:

True congenital short esophagus is rare (4 per cent of the cases in the authors' series). In an overwhelming majority of the cases shortening of the esophagus was acquired in the later years of the patient's life.

Basic anatomic factors in the development of hiatal hernia are congenital enlargement of the esophageal hiatus of the diaphragm and atrophy or weakness of the diaphragmaticoesophageal membrane.

Shortening of the esophagus develops as a result of "peptic" ulceration of the esophagus. Peptic ulceration of the esophagus may be the result of (1) excessive or prolonged vomiting, or (2) incompetence of the physiologic sphincter at the cardia, when it occurs in association with hiatal hernia or with reflex spasm of the lower part of the esophagus. Reflex spasm of the esophagus is the result of stimulation of the vagus nerve and may be produced by a variety of digestive disorders.

Dysphagia is the most common symptom associated with the short esophagus. In early stages, spasm may be the cause of dysphagia. However, organic stenosis of the lower part of the esophagus develops in most cases.

Hiatal hernia of the short esophagus type is not favorable for surgical treatment. When dysphagia is present, dilatation may be carried out by passing sounds over a previously swallowed thread. Medical measures are directed against further ulceration of the lower part of the esophagus.

Because the treatment of the short esophagus type of hernia is radically different from that of the usual hiatal hernia, it is important that an accurate diagnosis be made. Careful roentgenoscopic studies are necessary and esophagoscopic examination is frequently required if hiatal hernias of the short esophagus type are to be differentiated from hiatal hernias with an esophagus of normal length.

**Preoperative, Operative, and Postoperative Care in Esophageal Resections.** HERBERT C. MAIER. *Surgery*, 1948, 23: 884.

Recent advances in the reduction of morbidity and mortality following radical resection of the esophagus for carcinoma have been due to better preoperative preparation of the patient, improvements in anesthesiology, chemotherapy, a better understanding of the physiological alterations during and following operation, improved surgical technique, and better postoperative care.

*Preoperative preparation of the patient.* Because of the obstructive changes usually present in varying degrees, the esophagus should be cleansed above the tumor. All retained material and secretion should be aspirated and daily lavage of the esophagus instituted. Care should be taken that no aspiration into the lungs occurs. The importance of good mouth hygiene is emphasized. It is preferable to correct nutritional deficiencies if possible through feeding by mouth, together with supplementary parenteral injections, rather than to perform a preliminary jejunostomy. Gastrostomy is to be avoided in any case in which the stomach requires mobilization at the time of the esophageal resection. The correction of the hypoproteinemia as well as the other nutritional deficiencies may require a week or two. A fluid diet or, if feasible, a soft diet high in proteins, carbohydrates, and vitamins is given. In some cases preoperative blood or plasma transfusions and amigen are indicated. Vitamin C deficiency should be corrected by a daily dose of from 200 to 1,000 mgm. of ascorbic acid parenterally. Transfusions are given if the hemoglobin is less than 80 per cent after dehydration is corrected.

The preoperative work-up should also include an evaluation of the cardiac and renal status. Preoperative digitalization may be indicated. Any clinical or laboratory evidence suggesting coronary sclerosis requires constant effort to avoid anoxia at all times during and following operation. The presence of emphysematous lungs is important, since

slight changes in pulmonary expansion in the emphysematous individual may lead to respiratory insufficiency with resultant anoxia, which may in turn bring about cardiac complications. With recent advances in anesthesiology, preoperative pneumothorax does not seem advisable for esophageal surgery. Preoperative penicillin therapy is usually begun from 24 to 48 hours prior to operation. Before operation, a Levine tube is introduced through the nose and placed in the esophagus so that the end of the tube is just above the site of obstruction.

*Care of the patient during operation.* The fundamental principles are: (1) the avoidance of obstruction of the airway and adequate oxygenation throughout the operation; (2) adequate blood and fluid replacement throughout operation; (3) minimizing reflex disturbances in the operative field by the avoidance of unnecessary trauma; (4) minimizing contamination of the operative field; (5) maintenance of an excellent blood supply and avoidance of tension at the site of anastomosis; (6) periodic inflation of the lung during the intrapleural part of the operation, and (7) complete re-expansion of the lung as the pleural cavity is closed. In any case in which there is even a suspicion that the opposite pleural cavity may have been entered, a roentgenogram of the chest is taken in the operating room at the conclusion of the operation and inspected at once. If this shows any appreciable degree of pneumothorax, aspiration of the air with a syringe fitted with a three-way stopcock and connected to a monometer is indicated. Closed drainage is instituted on the side of the operation.

*Postoperative care.* In the experience of the author, hypoproteinemia has occurred following esophageal resection in spite of plasma transfusions, blood transfusions, amigen, or other protein derivatives administered parenterally. Perhaps the hypoproteinemia resulting from delayed feeding entails more leakage from the suture line than would occur if feeding were started early by mouth. Therefore, in addition to giving plasma, blood transfusion, and liberal doses of vitamin C postoperatively, the author begins feeding by mouth within 1 or 2 days of operation. Repeated plasma protein determinations are important.

The length of time the drainage tube is left *in situ* depends upon (a) the completeness of pulmonary expansion, (b) the thoroughness of evacuation of air and fluid from the pleural space, (c) whether the tube is still functioning or has been sealed off inside the thorax, and (d) whether the tube *in situ* would be a factor of safety should complications develop in the region of the anastomosis. It is obvious that the drainage must be kept airtight at least during the first week after operation if drainage has to be maintained for this long a period of time. When the tube is withdrawn, the withdrawal must be rapid, with immediate tying of the previously placed mattress or purse-string suture to close the opening.

The principles which must be observed to reduce postoperative cardiac complications are (1) avoidance of anoxia at all times, (2) avoidance of any interference with pulmonary ventilation, (3) avoidance of any appreciable drop in the blood pressure, (4) reduction of vasospastic factors as far as possible, and (5) avoidance of an increased tendency toward intravascular clotting due to changes in the blood constituents and blood flow. Digitalis has an important place in the postoperative therapy .

The principles to observe in avoiding reduction of bronchial secretion are (1) proper nursing assistance with manual support of the area of incision during coughing, (2) proper use of sedation with avoidance of undue pain, and (3) the early use of intratracheal suction if voluntary cough is impossible or ineffective. If these measures are followed, bronchoscopy, which is also an important therapeutic measure, will be necessary only occasionally. Therapeutic bronchoscopic aspiration should be employed with no hesitation. Bedside roentgenograms should be taken frequently in the postoperative period if it is thought that they might give information of value in the diagnosis and management of pulmonary complications.

Whether or not it is advisable to introduce the Levine tube past the gastroesophageal anastomosis into the intrathoracic portion of the stomach at the time of operation is a moot point.

Oxygen therapy, either through tent, nasal catheter, or mask, should be given to every patient. Early ambulation should be encouraged as much as possible and leg exercises in bed can be performed until the patient is allowed up.

HAROLD LAUFMAN, M.D.

**Surgical Management of Carcinoma of the Lower Two-Thirds of the Esophagus and Cardiac End of the Stomach.** JOHN W. STRIEDER. *J. Thorac. Surg.*, 1948, 17: 143.

The experience with 72 operations on 71 patients with carcinoma of the esophagus, occurring at or below the arch of the aorta, and of the cardiac end of the stomach is presented.

The youngest patient who had a successful resection was 52 years old; the oldest was 84. The general condition of the patient, especially the condition of the cardiovascular system, is of more importance than the chronological age. Involvement of the cervical lymph nodes is relatively rare, except in lesions high in the esophagus. In lesions below the arch, the lymphatic drainage tends to the periesophageal and the subphrenic regions, and to the nodes in the region of the celiac axis and left gastric arteries.

Metastatic lesions in the lungs and pelvis should be carefully sought. Involvement of the liver is a late manifestation. The tendency for primary esophageal lesions to spread in the wall of the esophagus is known, so that a wide excision of the tumor should be made when possible.

Esophagoscopy, with positive tissue biopsy, is almost always possible in cases of cancer of the esophagus, and is frequently possible when the esophagus is involved by high gastric cancer. At the

time of esophagoscopy, routine bronchoscopy has been done; on 4 occasions, the tumor was found to invade the left stem bronchus or trachea, which obviated the necessity for exploration.

The preoperative preparation, the operative technique, and the postoperative complications are discussed in detail. SAMUEL KAHN, M.D.

**Mesothelial Mediastinal Cysts (Pericardial Cysts): Differential Diagnosis of Shadows Continuous with the Anterior Inferior Mediastinum.** GEORGE COOPER, JR., VINCENT W. ARCHER, and JOHN R. MAPP. *South. M. J.*, 1948, 41: 285.

A circumscribed, homogeneous shadow projecting from the anterior inferior mediastinum and continuous with the shadows of the diaphragm and anterior chest wall is most apt to represent a mesothelial mediastinal cyst.

A number of other conditions, benign and malignant, cannot be ruled out without biopsy.

Demonstration of such shadows is indication for exploratory thoracotomy. JOHN J. MALONEY, M.D.

## MISCELLANEOUS

**Spontaneous Mediastinal Emphysema and Spontaneous Pneumothorax; a Report of 20 Cases.** HELEN A. DICKIE. *Ann. Int. M.*, 1948, 28: 618.

That spontaneous mediastinal emphysema is not a rare condition is indicated by the rapidly increasing number of case reports in the literature. Quite commonly there is an associated spontaneous pneumothorax. Over a 4 year period 20 cases of pneumomediastinum, pneumothorax, or a combination of the two, were diagnosed among students seen at the University of Wisconsin Student Health Service. In 6 cases pneumothorax alone was present; 7 individuals showed mediastinal emphysema without pneumothorax, and in 7 patients both conditions were present.

The mechanism of the production of a spontaneous pneumomediastinum is obscure, and the usual explanation is that air from a ruptured alveolus in the lung has caused dissection along the perivascular sheath to the mediastinum. The experimental work of Macklin with cats showed the associated pneumothorax to be caused by a rupture of the mediastinal pleura with the resultant escape of air into the pleural space. The frequent association of the two states, as seen clinically, suggests that this same mechanism may occur in the majority of spontaneous pneumothoraces seen in otherwise healthy individuals. The reason for the distention and rupture of the alveolus is not known; there is usually no history to suggest increased intrabronchial tension preceding the onset. In many of the cases the student was sitting in class or at study when the rather dramatic symptomatolgy suddenly ensued.

Characteristically, the onset of spontaneous pneumomediastinum is sudden with pain of varying severity felt substernally with radiation to the back, neck, shoulder or, occasionally, as in angina pectoris, to the little and ring fingers of the left hand. In about half of the cases peculiar noises over the precordium are audible to the patient. On examination a crunching sound which varies with the phase of respiration or with changes in position is heard over the precordium. Often this sound is similar to that of pericardial friction rub. Hyperresonance over the precordium is a constant finding.

In only 3 of her 14 cases could Dickie demonstrate mediastinal air by means of roentgenograms or the fluoroscope, even with repeated examinations in various positions. Unless the mediastinal air is large in amount or is localized, there is insufficient contrast with the air-containing structures about the mediastinum to make it visible: this difficulty is further increased by the associated pneumothorax, which is commonly on the left side.

Electrocardiograms show no constant pattern for mediastinal emphysema, with or without pneumothorax, but are of value in excluding the more serious conditions, such as coronary occlusion or pericarditis, which have a similar syndrome.

The disease runs a benign course, and treatment in the main is purely symptomatic. Cough should be controlled, but sulfonamides or antibiotics as prophylaxis against mediastinitis are not recommended. When the acute symptoms of mediastinal air have subsided the patient is treated on an ambulant status. Because of the alarming onset of the condition, patients must be reassured that they have no serious cardiac or pulmonary pathology.

WAYNE F. CAMERON, M.D.

**Congenital Diaphragmatic Hernia: Anatomic and Surgical Importance of the Left Triangular Ligament of the Liver.** PHILIP THOREK. *Arch. Surg.*, 1948, 56: 238.

A not uncommon lesion in the newborn is diaphragmatic hernia. Morgagni (1769) was the first to give this subject serious consideration although Paré had reported 2 traumatic instances as early as 1610. Case reports now number in the thousands. The relative increase in frequency appears to be due to better diagnostic methods and the consideration by clinicians of its existence.

Since elements of the adult diaphragm are derived from several embryological sources, various defects are possible, according to the location and extent of the developmental anomaly. The following classification is given:

1. Herniation through the posterolateral portions of the diaphragm along the embryonic pleuroperitoneal canal (foramen of Bochdalek). This is the most common location; the left side is involved four times as frequently as the right.

2. Herniation through the esophageal hiatus, due tc lack in development of one or both diaphragmatic crura.

3. Herniation through the retrosternal area (foramen of Morgagni). This is a herniation through the region of the retrosternal attachments of the diaphragm and is the least common type.

Herniations through the aortic and vena caval openings have not been reported. A diaphragmatic hernia may or may not have a sac limiting its superior border.

Congenital diaphragmatic hernias produce symptoms manifested by the respiratory, circulatory, and intestinal systems, according to the viscera interfered with and the severity of displacement. Any newborn who displays cyanosis, dyspnea, and vomiting, or any combination of these should be suspected of having a diaphragmatic hernia. Symptoms vary greatly in degree from intermittent attacks of vomiting, cyanosis, respiratory difficulty, and vague dyspepsia to constant distress with any of these.

Physical findings of a congenital diaphragmatic hernia are usually limited to increased pulse and respiratory rates, although the affected side may be less mobile and there may be some dullness to percussion or tympany, according to the viscera present within the chest. The diagnosis is established by roentgenological examination of the chest. Although the viscera forming the hernia can usually be determined with ordinary x-rays, a barium swallow is necessary in some instances.

The treatment of this condition is surgical. The earlier such patients can be operated on, the less distention and enlargement there will be of the intestinal viscera within the chest. Preoperative measures are designed for deflation of the alimentary tract, the establishment of proper hydration, and prophylactic chemotherapy. Although a transthoracic approach is best in adults, the abdominal route is superior in infants. The author emphasizes the importance of the left triangular ligament of the liver. This is a bloodless fold of peritoneum, of which severance permits mobilization of the left lobe of the liver to the right with immediate visualization and adequate exposure of a hiatal hernia. Positive pressure anesthesia is essential. After the abdominal viscera have been reduced from the thoracic cavity, the hernial sac, if one is present, should be excised and sutured, and the diaphragmatic defect repaired. Usually this is best accomplished by interrupted cotton sutures. Closure of the abdomen may be difficult, and interrupted through-and-through sutures are suggested rather than a closure by layers.

Postoperative care should include blood transfusion, oxygen therapy, early oral feeding, chemotherapy, and frequent chest roentgenograms.

The case of a 7 weeks old female infant with a congenital diaphragmatic hernia through the esophageal hiatus is presented. The herniation was due to nondevelopment of the left crus of the diaphragm. The symptomatology was that of cyanosis, convulsive seizures, and postprandial vomiting. Physical examination revealed moderate cyanosis, decreased expansion of the left side of the chest, and hyperresonance of the right chest with tympany in the lower portions of the left chest. The left border of the heart was at the right midclavicular line. Roentgenological findings diagnosed a diaphragmatic hernia. The child was operated on successfully with an uneventful postoperative period.

C. Frederick Kittle, M.D.

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Floss-Silk Lattice Repair for Inguinal Hernia.** RODNEY MAINGOT. *Lancet*, Lond., 1948, 1: 861.

The author has used a floss-silk posterior lattice-repair operation exclusively (Fig. 1) on all patients with a direct inguinal hernia encountered during the past 10 years. The same procedure was adapted for large oblique hernias in which the internal ring and the floor of the inguinal canal had been unduly stretched or in which the muscular and fascial supports appeared to be weakened and atrophied, as well as for certain types of recurrent inguinal hernias, particularly in enfeebled patients.

The immediate and late results were classed as excellent. Among the last 100 cases, sepsis developed in only 2 patients, but on removal of the offending ligatures and with penicillin therapy, healing was satisfactory. Sepsis most often occurred in obese patients, in the aged, and in patients who had had 2 or 3 or even more herniorrhaphies. Avoidance of supplementary operative procedures, such as those for varicocele and hydrocele, during operation on a hernia, as well as operation on only one side at a time has cut down complications.

STEPHEN A. ZIEMAN, M.D.

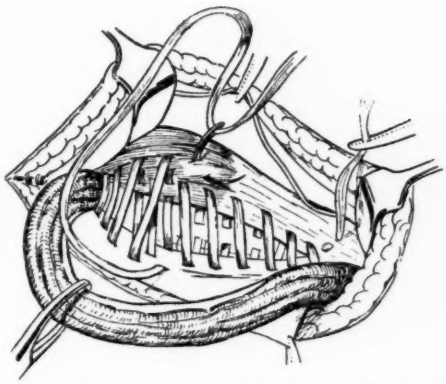

Fig. 1. (Maingot). Floss-silk lattice repair for inguinal hernia.

## GASTROINTESTINAL TRACT

**Observations on the Etiology of Postoperative Gastritis.** EDDY D. PALMER. *Gastroenterology*, 1948, 10: 671.

It is suggested that gastritis is more important postoperatively than is an anastomotic ulcer. Vomiting, bleeding, weight loss, and pain aggravated by food are the more important complaints.

The author's material consists of 24 cases. There was a rigid selection of cases with elimination of the cases which included any complicating factors. The patients included 1 woman and 1 negro. Their ages varied from 19 to 66 years. Four had a simple gastrotomy or gastrostomy, 1 had an esophagogastrostomy, 8 had gastrojejunostomies, and 11 had subtotal gastric resections. All of the patients were hospitalized for study. Complete work-ups were carried out and a rather rigid routine was adhered to. Six tables are presented in detail.

It was found that most postoperative chronic gastritis represents merely the continuation of preoperative gastritis, with or without surgical aggravation. Chronic gastritis which is due to surgery is of the superficial atrophic type. The secretion activity of the stomach plays little or no part in the postoperative development of gastritis. In cases in which there is rhythmic activity of the stoma, gastritis may still develop.

Modern resection technique apparently did not prevent the development of postoperative gastritis. Gastritis, preoperative or postoperative, is an important complication of gastric surgery.

RICHARD J. BENNETT, JR., M.D.

**On Gastric Myoma and Fibroma.** SAKARI TIMONEN. *Ann. chir. gyn. fenn.*, 1948, 37: 52.

The author presents 3 cases of benign tumors of the stomach which were removed at operation. The first was a benign bleeding myoma, the second a fibroleiomyoma or stenosing type of myoma, and the third a fibroma showing no serious symptoms. These were all benign nonepithelial gastric tumors.

A reliable diagnosis was not made postoperatively in any of the cases, which is not unusual for these tumors. Histological diagnosis offers difficulties in determining the type of tumor and in ruling out malignancy. For these reasons, gastric resection is recommended as the proper surgical procedure.

STEPHEN A. ZIEMAN, M.D.

**Carcinoma of the Stomach.** CLAUDE E. WELCH and ARTHUR W. ALLEN. *N. England J. M.*, 1948, 238: 583.

A study of all the patients with carcinoma of the stomach admitted to the Massachusetts General Hospital, Boston, during the 10 year period from 1937 to 1946 shows that the delay before treatment has remained unchanged, an average of 5 months. However, the more aggressive attitude toward gastric ulcer has increased the recognition of early cancer of the stomach.

The introduction of a transthoracic approach and the wider use of total abdominal gastrectomy have increased the number of cases available for resection.

The mortality for gastric resections for cancer has dropped to a present level of 17 per cent for the entire series and to 11 per cent in the last 5 year period.

The mortality of subtotal resections in which all gross disease is removed has been 3 per cent in the last 5 year period.

The number of patients not subjected to operation has declined. Seventy-five per cent have an operation. Fifty per cent of the total have a gastrectomy, either subtotal or total.

The best palliative operation, if gross disease cannot be removed, is subtotal gastrectomy.

The 5 year survival rate is now 7 per cent of the entire group that enters the hospital.

The best method now available to increase the number of cures of cancer of the stomach is to reduce the delay from the onset of symptoms to the surgical intervention. CHARLES BARON, M.D.

**The Problem of Gastric Cancer in a University Hospital.** H. GLENN BELL. *Surgery*, 1948, 23: 351.

This brief statistical study from the University of California Medical School presents figures in substantial agreement with those from similar institutions.

There were 540 patients with carcinoma of the stomach, of whom 69.2 per cent were operated upon, and 34.4 per cent of the total were resectable. Therefore, in 65.5 per cent or approximately two-thirds of the patients seen a curative type of surgery could not be attempted.

The lesions at the pyloric end of the stomach accounted for more than 90 per cent of the cases resected. Of the 137 patients with lesions at the pyloric end, 14 (18.9 per cent) were alive longer than 5 years and 30 others were alive but had not yet reached the 5 year period. Other lesions of the stomach offered less hope, none of the patients being alive after 5 years; however, of 49, 8 were alive but had not yet reached the 5 year period.

The operative mortality dropped from 22.2 to 11.9 per cent in the last 5 years.

The points stressed are that better training of all physicians, and earlier diagnosis or examination for cancer of the stomach would increase the number of cases suitable for resection, and that doctors and laymen should be acquainted with the cure rate in cancer of the stomach so that they will not blandly accept a fatalistic attitude when the diagnosis is made. FREDERICK C. HOEBEL, M.D.

**Total Gastrectomy with Esophagoduodenal Anastomosis.** JAMES T. PRIESTLEY and FRANK KUMPURIS. *Arch. Surg.*, 1948, 56: 145.

The purpose of this article was to draw attention to one method of restoration of gastrointestinal continuity, after complete removal of the stomach, which has received little consideration in recent years.

Interest in this subject, on the part of the authors, was stimulated by 2 recent cases in which the pathologic process and anatomic relationships were such that the duodenum could be readily anastomosed to the esophagus after removal of the entire stomach.

Previous experience with esophagoduodenal anastomosis after total gastrectomy was mentioned briefly. The 2 cases in which this type of operation was performed recently are presented. It was stressed that this procedure is suitable only in a selected group of patients. The technique of operation is briefly described. Esophagoduodenostomy is considered advantageous when practical because of its comparative simplicity and the elimination of unnecessary suture lines, and also because of the more nearly normal anatomic and physiologic restoration of gastrointestinal continuity which results.

**Gastrostomy.** DONALD R. COOPER and ROBERT W. BUXTON. *Surgery*, 1948, 23: 821.

Gastrostomy, as a measure for the control or improvement of the nutrition of ill patients, has long been a standard surgical procedure carried out upon selected patients. In a recent editorial, however, it was indicated that the life expectancy of the majority of patients upon whom this procedure is carried out is little, or possibly adversely, affected by this operation.

The performance of gastrostomy is one of the earliest of surgical procedures. Because of some of the technical difficulties encountered in carrying out this simple operation, or because of the subsequent unsatisfactory functioning of the gastrostomy, many methods and variations have been advocated by various surgeons. At the present time the fashioning of a gastrostomy is varied by each surgeon to meet the needs of a particular situation and little importance is attached to the use of difficult or elaborate techniques. Since many gastrostomies are considered temporary expedients and not permanent fistulas, the simpler procedures are believed to be most suitable. In many instances, because of the poor general condition of the patients, the simplest procedure carried out under local anesthesia is obligatory.

In attempting to correlate the surgical complications and the difficulties entailed in the postoperative feeding regimes, a detailed examination of each complication in relation to the surgical technique used was made. The percentage of complications encountered in each instance was, with one exception, without significant difference; a significantly greater number of patients experienced stomal malfunction after the Stamm type of gastrostomy.

Again, the type of anesthetic agent was implicated in the production of increased morbidity and mortality rates. In each case the anesthetic agent in a series of patients was chosen to meet the qualifications of the patient and the requirements of the surgeon. In a group of 194 patients, gastrostomy was carried out 109 times with local procaine infiltration anesthesia, 79 times under general inhalation anesthesia, and 6 times with spinal anesthesia. No clear-cut correlation between postoperative complications or death and the incorrect choice of anesthetic was noted.

In 82 patients (42 per cent) of the 194 upon whom gastrostomy was performed no postoperative complications occurred. In the remaining 112 patients a total of 147 complications occurred.

Pneumonitis was the most frequent complication. There appeared to be close correlation between the severity of malnutrition and the incidence of pneumonitis in these patients, in that 41 of the 47 patients gave evidence of extreme weight loss, anemia, and hypoproteinemia. Twelve of these 47 patients had congenital esophageal atresia with tracheoesophageal fistulas. This primary lesion may well have contributed to the incidence of pneumonitis.

The incidence of phlebothrombosis or thrombophlebitis and pulmonary embolism can be explained only by the failure of the attending physician to look for or find evidence of venous thrombosis in the lower extremities.

A palliative gastrostomy in patients with inoperable malignant neoplasms or other hopelessly incurable lesions produces no significant extension of life and no demonstrable nutritional improvement.

Since neither life expectancy nor outstanding nutritional improvement is to be gained by "palliative" gastrostomy, the use of this procedure for hopelessly incurable lesions must depend upon the surgeon's judgment as to the degree of physical and mental satisfaction which will be gained by such an operation for each patient.

Gastrostomy in patients with non-neoplastic curable lesions of the hypopharynx, esophagus, and esophagogastric junction serves admirably as a means of furthering the local treatment of these areas. When the nutritional need is great in these patients, the nutritional response is maximal only when the gastrostomy feeding is supplemented by an oral diet.

A satisfactory state of nutrition is best maintained in esophagectomized patients when they are able to ingest a diversified diet through either an artificial or a surgically reconstructed esophagus.

HARRY W. FINK, M.D.

**Hypertrophic Pyloric Stenosis in the Adult** (Stenosi pilorica ipertrofica dell'adulto). RAFFAELE MAZZETTI. *Gior. ital. chir.*, 1948, 4: 65.

The case reported by Mazzetti occurred in a woman 44 years of age who had been in good health until the age of 25 when the first gastrointestinal disturbances appeared on the occasion of her first pregnancy and persisted for about 3 months after delivery. She was then well for 2 years, after which the symptoms recurred. Three years later, during her second pregnancy, the symptoms became worse and persisted since then with the exception of rare and short intervals. The symptoms consisted of epigastric heaviness, moderate pain, slow and difficult digestion, frequent eructations, and sometimes nausea and vomiting. Gradually the patient has lost considerable weight. For the last 3 months her symptoms had been worse and the resulting asthenia reduced her to complete inactivity. Sedative treatment afforded no relief.

On admission, the abdomen was not painful on superficial palpation; the stomach was partially filled with fluid. Roentgen examination revealed a picture of gastric ptosis with marked delay in emptying. Laparotomy disclosed a dilated stomach with a strongly hypertrophic pyloric ring and stenosis. There was moderate perigastritis and periduodenitis at the posterior aspect. A Hoffmeister-Finsterer gastric resection was performed. The histologic diagnosis was hypertrophy of the pylorus.

It was difficult to establish with certainty what the real cause of the hypertrophy of the pylorus had been. It could not be attributed to an inflammatory process or to ulceration because the histologic examination excluded this possibility. The mild perigastritis and periduodenitis had to be considered secondary to the hypertrophy because these irritative conditions were too slight to have determined such a conspicuous hypertrophic change. Besides, these conditions are encountered rather frequently and have a silent course, while pyloric hypertrophy is rare.

It seemed probable that the present case, like other similar ones, represented a congenital hypertrophy which had long remained latent and had been stimulated by the occurrence of a banal gastritis during pregnancy. That the gastric disturbances were the contributing factor was suggested by the fact that they were the only data worthy of consideration in the history of the case; in addition, other authors have reported that mild gastritis is capable of making manifest a latent state of hypertrophy.

The correct diagnosis was made only at operation. Gastric resection was favored because the condition of the patient allowed it and only a radical operation affords protection against possible recurrence and malignant degeneration. When the patient was seen 10 months after operation, she had gained considerable weight, had not had any more digestive disturbances, and was in good general condition.

RICHARD KEMEL, M.D.

**Reduction of Intussusception by Hydrostatic Pressure. An Experimental Study.** MARK M. RAVITCH and ROBERT M. MCCUNE, JR. *Bull. Johns Hopkins Hosp.*, 1948, 82: 550.

This work was undertaken in order to determine experimentally the likelihood of perforation when intussusception is reduced by hydrostatic pressure. The intussusception was produced in dogs by stimulating a portion of the terminal ileum with a faradic current from an induction coil, seizing it with rubber-shod forceps while still contracted, and inverting it into the distal segment. If the entire intussusception was produced in this manner, the serosal surfaces were sufficiently traumatized so that firm adhesions developed within 12 hours, which made reduction impossible by hydrostatic pressure and difficult by direct manipulation. Therefore, in subsequent animals the intussusception was initiated in this way with forceps and continued the rest of the distance with a smooth glass rod. Intussusceptions of 15 cm. in length were regularly produced.

It was shown that, except in one animal, whenever an intussusception could be reduced by hydrostatic pressure, the animal survived indefinitely.

Pathological studies indicated that the returning limb was regularly found to be severely damaged, even to the point of gangrene, at a time when the bowel in the entering limb was still viable. This was undoubtedly due to the devascularization of the returning limb by the acute kinking of the bowel as it turned on itself at the apex of the intussusception. Hemorrhage and engorgement disappeared first after reduction, then edema, and, lastly, cellular infiltration. The mucosa was frequently partially sloughed or eroded, and pathogenic bacteria made their way through to the serosal surface even in bowel which appeared apparently well preserved. This may have been a partial explanation of the fever seen clinically after reduction, and of the frequency of abscesses and infections after operative reductions.

Intussusceptions of 18, 28, and 38 hours of duration in dogs can be reduced by a hydrostatic pressure of 3 feet. Intussusceptions of 48 hours of duration are usually not reducible by hydrostatic pressure.

HAROLD LAUFMAN, M.D.

**Mucoceles of the Appendix with Tumorous Tendencies** (Les mucocèles de l'appendice à détermination tumorale.). MARCEL ROUX AND L. M. ROGNON. *J. Chir.*, Par., 1948, 64: 5.

Mucocele of the appendix may produce a rare type of palpable tumor in the right side of the abdomen or flank. The authors report such a case in a 55-year-old woman. The history and findings are reviewed.

A right pararectus incision is recommended for exposure of these lesions because it permits exploration of the region and excision of a free mucocele and because it can be extended proximally to permit hemicolectomy when necessary.

EDWARD W. GIBBS, M.D.

**Surgery of the Lower Bowel.** HARRY E. BACON and ROBERT J. ROWE. *J. Am. M. Ass.*, 1948, 136: 975.

The authors report a reduction in the mortality rate for colon resection from 6.4 per cent in 346 cases observed prior to January 1946 to zero in 142 cases observed subsequent to that date. This low figure is attributed to careful preoperative evaluation, preparation, and postoperative care. Surgical technique is not discussed.

The patient who requires colon surgery should be hospitalized for several days prior to the operative procedure. During this time he is carefully evaluated as to surgical risk. Every means is utilized to place him in optimal nutritional, fluid, electrolyte, nitrogen, and vitamin balance. Hepatic and renal dysfunction must be corrected. The bowel is prepared with a combination of phthalylsulfathiazole and streptomycin, the latter being limited to the period from 48 to 72 hours immediately before surgery to avoid the development of streptomycin resistance.

Proper postoperative management embraces adequate nutrition and fluid balance. Penicillin is given routinely. A rigid program of early motion and anticoagulant therapy is the best prophylaxis for thromboembolism. Other postoperative complications and means to prevent them are described.

EDWARD W. GIBBS, M.D.

**Clinical Aspects of Carcinoma of the Cecum and Ascending Colon: Report of 60 Cases.** CHARLES H. BROWN, JAMES R. COLVERT, and BROCK E. BRUSH. *Ann. Int. M.*, 1948, 28: 940.

The authors analyze 60 case histories of carcinoma of the cecum and ascending colon. The predominating symptoms were pain (76 per cent), obstruction with cramps and colic (38 per cent), vomiting (21 per cent), diarrhea (20 per cent), and anemia with less than 13 gm. of hemoglobin (79 per cent) and with less than 11 gm. (54 per cent).

The most noteworthy findings were that 32 per cent of the patients had an annular type of growth and 25 per cent a constricting or obstructive lesion. The immediate postoperative mortality in the last 5 years was 8 per cent. Seventy-one per cent of the patients, with no evidence of metastases, are living for an average of 3.8 years after operation, whereas 29 per cent, with metastatic lesions, are living on an average of 4 years after operation.

STEPHEN A. ZIEMAN, M.D.

**Microcolon.** JOHANNES ZIMMER. *Acta radiol.*, Stockh., 1948, 29: 228.

The congenitally small colon or microcolon designates a condition in which the entire large bowel (except the rectum) of a newborn infant is anatomically found to have a diameter of around 4 to 8 mm. The condition has been reported rather infrequently. There are two types of microcolon, the primary and the secondary. In both types microscopy reveals a perfectly built normal bowel, consisting of all layers but with a small lumen. The primary type, according to various authors, is attributable to developmental factors, primary dilatation and hypertrophy of the small intestine, primary hypoplasia of the colon, temporary incarceration of a segment of the small intestine, changes in the innervation, and mechanical factors, while the secondary type is due to organic obstruction. The author presents the findings in 2 cases, one of each type.

The following two roentgenologic features are stressed: (1) the absence of fluid levels in the intestinal tract on vertical roentgenograms must be due to the inspissated content in the bowel and is probably pathognomonic of meconium ileus, and (2) the absence of taut plicae circulares in the small intestine, which makes it almost impossible to distinguish between the small bowel and the colon.

In cases of organic obstruction two points should be noted: fluid levels are often present and hard, granulated fecal matter is not seen in the roentgenograms.

Barium enema may be of diagnostic value. A barium meal is usually contraindicated. The roentgen examination is usually of value in establishing a diagnosis of microcolon.

FRANK L. HUSSEY, M.D.

**Modern Trends in Surgery of the Colon.** MOSES BEHREND and ALBERT BEHREND. *Surg. Clin. N. America*, 1948, 28: 525.

The authors have discarded the Mikulicz operation except in those patients with absolute intestinal obstruction. Its undesirable features are that it is a staged operation and that it requires long hospitalization with its attending economic strain on the patient. Notwithstanding the fact that it is one of the safest operations to perform on the colon, the disadvantages as cited are so great that it has been replaced by other simpler and less time-consuming procedures.

The newer procedures have been made possible by better knowledge of the physiology, anatomy, and the application of chemotherapy before and after operation. This knowledge is applied in the form of preoperative and postoperative precautions which must be adhered to so that the best results may be obtained. The operation, dependent upon the anatomicopathological location of the tumor, is described. The one-stage resection and primary anastomosis of the colon when the lesion is proximal to the rectosigmoid junction is strongly recommended. Even here, when the colon and lesion can be mobilized, it may be possible to perform this operation. Beyond the rectosigmoid junction the Miles operation is employed, the Babcock-Bacon operation having proved less satisfactory in the author's hands.

Old age is not considered a deterrent to operation for cancer of the colon. The case of an 85 year old patient is discussed, as also is a case of melanosarcoma of the colon exhibiting the same symptoms as were found in carcinoma of the colon.

STEPHEN A. ZIEMAN, M.D.

**Factors Influencing the Healing of Anorectal Surgical Wounds.** JOHN MCGIVNEY. *South. M. J.*, 1948, 41: 401.

The factors which influence the healing of anorectal wounds are the general condition of the patient, rest of the part, the presence of foreign bodies in the wound, the blood supply, incomplete removal of the lesion, infection, and the behavior of the wound.

There are two principal forces acting upon wounds in this area—one in a medial and cephalad direction and one in a side-to-side fashion. If a surgical wound in this region is of such a character that the medial and caphalad forces acting upon it predominates, there will be a great tendency for the outer extremity of the wound to be drawn into the anal canal, with the likelihood of its becoming undermined with resultant postoperative sinus and abscess formation. This is particularly true when the wound is located in the anterior or posterior commissures of the anus where the fibroelastic extensions are much more numerous. If a sinus or an abscess develops in the wound the prolonged infection leads to the formation of an excess of scar tissue and a delay in the covering of the wound with epithelium. In order to avoid this complication, surgical wounds of this area should always be extended outward beyond the influence of the fibroelastic extensions so that the medial and upward force has little or no influence upon the wound, and it is permitted to heal side-to-side. The wound edges should be beveled and the longitudinal ends tapered so that there is a gradual slope to the skin surface in all directions. This type of wound is not likely to become complicated by "bridging" or undermining of its edges. The problem of wound healing resolves itself into one of making every effort to minimize infection and of promoting local resistance of the tissues.

Sulfathalidine given by mouth has been found to be effective in diminishing the infection of anorectal wounds.

The postoperative care of an anorectal wound largely determines the rate of its healing. Oxycel gauze as a postoperative dressing will greatly decrease postoperative bleeding and will not interfere with healing of the wound. The gauze is liquefied and absorbed or discharged from the wound in 72 hours. The wound is examined daily, spreading apart the buttocks and separating the edges of the wound. This tends to discourage early "bridging" of the tissues. "Furacin" is applied to the wound with a small sterile cotton-tipped applicator at each examination. On the second postoperative day warm moist applications are applied to the wound and on the following day, after an enema brings the first bowel movement, hot sitz baths are given the patient. While in the tub, the patient is instructed to hold his buttocks apart so that the water may enter the anal canal. Sitz baths are repeated twice daily. In the interval, a soft piece of cotton is placed in the wound to protect its surfaces from physical injury.

After the patient leaves the hospital, he is seen twice weekly in the office and at each visit the wound is inspected for "bridging," pocketing, or undermining of its edges. The appearance of an excess of granulation tissue usually indicates bridging of the wound, sinus formation, or undermining of the wound edges. When these complications of healing are discovered, they should be corrected immediately. Granulation tissue tabs should be excised and the flat granulating surfaces which project above the skin surface should be treated with a silver nitrate applicator. Undermining of the wound edge is usually present in the longitudinal end of the wound and is treated by raising a small wheal of procaine in the skin over the area and opening up that portion of the wound with a small pair of scissors. The edges of the skin are then trimmed back and bleeding is controlled with an oxycel dressing.

CHARLES BARON, M.D.

## LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**The Use of the Long T-Tube in Surgery of the Biliary Tract.** RICHARD B. CATTELL. *Surg. Clin. N. America*, 1948, 28: 659.

The author discusses the uses of the long T-tube in surgery of the biliary tract. In contrast with the

conventional T-tube which has a 4.5 inch transverse limb, the long T-tube has a 12 inch horizontal limb which is the approximate length of the vertical portion and is made either of the usual red rubber or of pure gum or of synthetic rubber. Because of a problem in manufacture it is easier to join two equal lengths of tubing at the midportion of one so that each end is 6 inches long.

Increasing numbers of patients have been encountered in the past 10 years with obstruction of the biliary duct persisting after previous operations. The author believes that such unsatisfactory results may be avoided by employing the long T-tube with the distal limb passing through the papilla into the duodenum. This tube is specifically advocated for: (1) recurrent common duct stones; (2) fibrosis of the ampulla of Vater; (3) repair of benign strictures; (4) malignancy of the bile ducts; (5) certain gastroduodenal resections in duodenal ulcers; and (6) duodenal diverticula.

The author discusses the theoretic objections to placing a tube through the ampulla, particularly the possibility of reflux of the duodenal content into the biliary duct system. In his large experience he has rarely observed the occurrence of this complication. These patients have so rarely developed attacks of cholangitis, as evidenced by the occurrence of transient jaundice, malaise, chills, and fever, even though the tube was left in place for a year or more, that use of the long T-tube is not contraindicated. The author dutifully, however, emphasized that these tubes require irrigations throughout the time they remain in place. During the immediate postoperative period alimentation can be utilized, and thus the amount of intravenous therapy may be decreased.

ROBERT TURELL, M.D.

**Congenital Cystic Disease of the Liver.** LAWRENCE CHAFFIN. *West. J. Surg.*, 1948, 56: 193.

Nonparasitic hepatic cysts occur singly, in small or large groups, or in extreme profusion. The author reports 3 cases illustrating various features of congenital cystic disease. Clinical differentiation between the solitary cyst and polycystic disease remains impossible. Yet, in these two situations the treatment as well as the prognosis differs significantly, for solitary cysts are often pedunculated and favorable for extirpation, while polycystic disease often affects large or distant areas of liver parenchyma together with vital structures, or occurs in association with cystic degeneration of the kidneys or some other organ. In exceptionally favorable circumstances the removal of a polycystic mass of hepatic tissue has been accomplished successfully, but such a rare, special, and fortunate distribution of the disease does not alter in general the surgical principle not to attack polycystic disease of the liver rashly.

In the treatment of polycystic disease, excision of an entire lobe or its affected portion offers the only reliable method of cure. This radical procedure may not be considered if polycystic disease exists in the kidneys or another organ. Ordinarily the anatomic situation can be defined only by exploration, at which time a choice must be made between excising the involved portion of the liver, or doing nothing. Excision of the lesion is contraindicated in the presence of ascites or in cystic disease of the liver without symptoms.

The earliest symptoms often proceed from the associated polycystic disease of the kidneys. Polycystic disease of the liver may not interfere with good health, since symptoms are usually due to pressure. Liver function tests are ordinarily normal. The right lobe of the liver is involved about 5 times more often than the left, and women are more frequently affected than men. Approximately one-half of the reported cases of congenital cystic disease of the liver have been polycystic, and the average age of the patients has been 33 years. No pathognomonic features are produced by the cystic liver.

JOHN L. LINDQUIST, M.D.

**The Acute Gall Bladder.** SAMUEL F. MARSHALL and E. S. PHILLIPS. *Surg. Clin. N. America*, 1948, 28: 633.

Acute conditions of the gall bladder should very properly be classified as emergencies, and surgical treatment should be undertaken as early as the general condition of the patient will permit.

The authors report a series of 74 patients with acute disease of the gall bladder, who submitted to operation. The diagnosis had been established by careful pathologic examination of the removed specimens.

In 1923 Walton, of England, proposed operation early after the onset of the disease process and thereby precipitated a more or less controversial discussion of surgical management as it relates to the optimal time for surgical intervention. In 1930, in this country, many surgeons questioned the advisability of this method of surgical treatment, and by 1933 many articles appeared in the literature with proponents for both the immediate and delayed methods of surgical treatment.

Statistics were cited to support both viewpoints; however, very often the definitions "early" and "immediate" operations had diverse meanings in the different series and consequently permitted no comparison of surgical results. The authors believe that a more logical approach to the problem would be to define "early operation" so as to include those patients operated on within 72 hours of the onset of acute symptoms; "intermediate" after from 72 hours to the complete cessation of clinical manifestations, and "late" as any time after the clinical remission of objective and subjective symptoms. They would prefer to regard all cases of this nature as emergencies, to admit all patients at once to the hospital, and to operate as soon as the diagnosis can be established, the patient's general condition can be evaluated, and the chemical and fluid balance can be restored. These operations should very properly be listed as "early" surgical procedures. This should be the ideal method of treatment, wherein operation could be carried out

before the development of marked inflammatory changes and before the development of serious complicating factors which so profoundly influence morbidity and mortality.

A careful study of this series of 74 pathologically proved cases of acute cholecystitis, and of their clinical manifestations, confirms this conclusion of the unpredictability of clinical signs and laboratory findings in estimating the degree of inflammatory change.

Furthermore, the inability to follow the pathologic process accurately by clinical means is illustrated by the fact that perforation occurs in from 6.82 per cent (Bachhuber) to 13 per cent (Clagett), and to 20 per cent in the large collected series reported by Heuer. The average reported mortality in cases of perforation is about 45 per cent. This does not include other or subsequent sequelae of a perforated viscus. There were 9 perforations among the 74 cases reported.

The highest mortality still remains in the older age group who have concomitant organic disease. In Bachhuber's series, 69.23 per cent of the patients were over 63 years of age and almost all had had repeated attacks as well as concurrent disease. M. K. Smith stated that the fatalities are confined to the older age group and that peritonitis is not so frequently a cause as suspected. Eliason and Stevens found the mortality after 60 years to be eight to ten times greater than that before the age of 60; they also discount the factor of infection as a contraindication to early operation. Bachhuber best summarized the situation when he wrote: "For the more recurrent attacks the patient has, the older the age, the more likely it is that the patient may also be suffering from some serious concomitant disease, all of which contributes to the mortality."

Stones in the common duct are more often an accompanying feature of acute cholecystitis than is generally thought. Thirty-five of the 74 patients whose cases are reported had common duct explorations. Stones were found in 12 cases, an incidence of 16.2 per cent, which very closely parallels the occurrence of common duct stones in the chronic calculous gall bladder. Common duct stones should be searched for just as carefully in acute disease of the gall bladder as in the chronic uninflamed gall bladder, and will just as frequently be found.

Cholecystectomy was accomplished in 73 cases. In 51 cases, however, the operating surgeons elected to do the dissection from the fundus to the cystic duct instead of carrying out a retrograde dissection as is the usual method in this clinic. The marked edema makes this method of dissection easier and safer in most cases, since it permits easier visualization of the cystic artery, cystic duct, and also the common duct which may be obscured by the marked edema which often involves the tissues over the common duct to a marked degree. Of the 11 patients operated on within 48 hours of the onset of symptoms, 5 had dissections from the fundus to the cystic duct and 6 in the retrograde manner. Perhaps the sulfonamides and antibiotic agents will in many instances affect the time of surgical intervention, but undoubtedly if the acute gall bladder were considered and treated as any other acute abdominal emergency, morbidity and operative risk could be kept at a minimum. These therapeutic agents are by no means a substitute for urgent surgery.

The authors have reported a consecutive series of 74 pathologically proved cases of acute disease of the gall bladder, with 1 postoperative death, a mortality of 1.3 per cent.

Acute cholecystitis is an acute surgical condition in which early operation, preferably within 48 hours after the onset of symptoms, permits a more thorough operation at less expenditure of time, money, and suffering on the part of the patient as well as reduction in the operative risk. Because of the relatively high incidence of common duct stones, they should be carefully sought for and removed in acute disease of the gall bladder as in other cases of disease of the gall bladder. Cholecystostomy has a limited indication in the treatment of acute cholecystitis but is a valuable surgical procedure in some cases. Early operation should reduce the mortality in the older age group as it lessens the hazards of depleted reserves in cases of concomitant disease. In an editorial entitled "Acute Cholecystitis—Why Delay," C. G. Heyd wrote: "The indication is to operate carefully with due celerity, relieve the mechanical obstruction, and provide drainage. Teachers of surgery who lend their prestige and give support to a policy of waiting provide authority for timid surgeons, inexperienced operators, and procrastinating practitioners."

BENJAMIN GOLDMAN, M.D.

**The Surgical Treatment of Acute Cholecystitis.**
FRANK GLENN. *Surgery*, 1948, 23: 397.

The philosophy of surgical removal of the gall bladder early in the acute phase of cholecystitis is based on the premise that removal of the gall bladder interrupts the pathologic process and averts the danger of gangrene and perforation. The procedure is contraindicated in the presence of peritonitis due to perforation of the gall bladder, when there are technical difficulties which make it impossible to identify important structures, in the presence of severe obstructive jaundice, and in patients whose general condition is so grave that they will not tolerate such an extensive procedure.

The patients over 50 years of age offer a much greater risk both because of more advanced disease of the biliary system and because of the frequency of a serious concomitant disease.

There were 586 patients in the series treated by early surgery. The over-all mortality was 17 deaths, or 2.8 per cent. There were 381 patients under 50 years of age with a mortality of 1.04 per cent, while in the group over 50 years, comprising 205 cases, the mortality was 6.1 per cent; the mortality following cholecystostomy and common duct exploration was relatively higher, which indicated that there was a much greater initial risk in the latter group.

The author believes that early operation for acute cholecystitis, both in relation to the individual at-

tack and the whole course of the disease, would lower the number of more complicated cases and the mortality for cholecystitis. This is illustrated by the young pregnant woman who has her first attack of the disease during her pregnancy but goes many years with many recurrent attacks and even greater risk before cholecystectomy is performed.

FREDERICK C. HOEBEL, M.D.

**Gall Bladder Gas Gangrene.** ROSWELL K. BROWN and ELMER MILCH. *Gastroenterology*, 1948, 10: 626.

The case histories of 39 patients who died following biliary tract surgery at the Buffalo General Hospital showed that 6 apparently had Clostridium welchii infections. Three of them died as an indirect result of Clostridium welchii infection, and in 3 others the infection may be considered as a major contributing cause of death. Two case histories are reported in detail—1 fatal case, and 1 case in which the patient did not die.

Diabetes mellitus was present in a mild degree in 3 of 7 cases. One survival was the only recorded instance of recovery at this hospital.

The patient who died was considered to be in a satisfactory condition for 12 hours, but then hematemesis and all the signs and symptoms of acute infection plus shock set in. He died 36 hours after operation. An autopsy was performed which showed that the greatest involvement was in the liver adjacent to the site of removal of the gall bladder. The patient who survived was a 60-year-old man. Roentgenograms showed a gas shadow in the gall bladder region which proved not to be in the colon. It is suggested that if this condition is encountered unexpectedly at operation, open packing of the wound would be advisable. The use of penicillin for all biliary tract surgery before, during, and after operation might help to eliminate this infection.

RICHARD J. BENNETT, JR., M.D.

**Choledochostomy: Its Place in Surgery of the Biliary Tract.** BENTLEY P. COLCOCK. *Surg. Clin. N. America*, 1948, 28: 641.

The author emphasizes his belief that the mortality in biliary tract surgery is closely related to the incidence of common duct stone and the delayed treatment of gallstones.

There is no group of symptoms or physical signs either before or at the time of operation which definitely exclude the presence of a common duct stone in a patient with disease of the biliary tract. This means that the advisability of exploring the common duct for common duct stone must be carefully considered in every patient operated on for cholelithiasis. If the history, physical examination, and operative findings are carefully reviewed and evaluated with this in mind, fewer common duct stones will be left behind, and the overall mortality of surgical procedures on the biliary tract will continue to decrease.

Just as there is no group of symptoms which will rule out a stone in the common duct, so there is no positive sign that a stone is definitely present in the common duct. Certain symptoms, such as jaundice, are so frequently the result of stones in the common duct that when jaundice is present one instantly thinks of this possibility; yet if the surgeon carrying out surgical procedures on the biliary tract limits his indications for exploring the common duct to the presence of jaundice, he will leave behind almost as many common duct stones as he removes.

There are a number of signs and symptoms which, if present in patients being operated upon for cholelithiasis, should suggest to the operating surgeon the advisability of exploring the common duct.

The most important indications for exploration of the common duct are those of jaundice, clinical or sub-clinical, a dilated or thickened common duct, small stones in the gall bladder, the positive finding of stone or stones in the common duct, the finding of dark bile and sediment on aspiration of the duct, and the presence of either acute or subacute pancreatitis.

The author points out the necessity for adequate exposure and careful exploration. He warns against the use of force in passing dilators into the duodenum and suggests the irrigation of the duct with saline per catheter. He is opposed to the use of immediate cholangiography. He prefers the use of a well secured T tube in the duct which is clamped off for one hour on the seventh postoperative day. This clamping is increased until the stools become well colored. A cholangiogram is made before the T tube is removed.

The advisability of exploring the common bile duct should be considered in every patient who has a cholecystectomy. It should be carried out if any one of a number of indications is present. Stones in the common bile duct will be overlooked, and the morbidity and mortality following surgical procedures on the biliary tract will be increased if jaundice is used as the sole criterion for exploring the common bile duct. BENJAMIN GOLDMAN, M.D.

**Choledochotomy.** ROBERT W. BUXTON and LLOYD B. BURK, JR. *Surgery*, 1948, 23: 760.

This study was made in the period from 1934 to 1946. There were 70 complications occurring in 439 patients with a morbidity of 15.9 per cent. In 7.2 per cent the complications appeared to be definitely related to choledochotomy alone. The mortality rates from choledochotomy have improved from 16 per cent in 1934 to 2 per cent in 1946. The authors suggest that certain criteria should be met before the common duct is opened. They are:

1. Palpable stone in the hepatic or common bile ducts.
2. Recent jaundice.
3. Dilatation of the duct or thickening of the bile ducts.
4. Clinical evidence of cholangitis.
5. Multiple small stones in the gall bladder.
6. Thickening or induration of the head of the pancreas.
7. Biliary colic without stones in the gall bladder.

TABLE I.—COMPLICATIONS FOLLOWING CHOLEDOCHOTOMY IN 439 CASES

| Complications | Number |
|---|---|
| Retained calculi | 26 |
| Stricture | 2 |
| T tube broken in removal | 2 |
| Duodenal fistula | 1 |
| Subhepatic bile abscess | 1 |
| Subphrenic abscess | 6 |
| Wound infection | 32 |
| Total | 70 (15.9%) |

TABLE II.—INDICATIONS FOR CHOLEDOCHOTOMY IN NONPALPABLE CALCULI (61 CASES)

| Indications | Number |
|---|---|
| Jaundice | 4 |
| Jaundice, dilated duct | 14 |
| Jaundice, dilated, thickened duct | 4 |
| Jaundice, small stones in gall bladder | 6 |
| Jaundice, dilated duct, small stones in gall bladder | 11 |
| Dilated duct | 3 |
| Dilated, thickened duct | 2 |
| Dilated duct, small stones in gall bladder | 4 |
| Dilated, thickened duct, small stones in gall bladder | 1 |
| Thick duct, small stones in gall bladder, recent jaundice | 1 |
| Dilated duct, recent jaundice | 4 |
| Recent jaundice | 1 |
| Recent jaundice, small stones in gall bladder | 1 |
| Small stones in gall bladder | 1 |
| Indurated, thickened head of pancreas, dilated duct | 1 |
| Biliary colic without gall bladder stones | 1 |
| Choledochoduodenal fistula | 1 |
| No reason given | 1 |
| Total | 61 |

The small contracted gall bladder is not considered an indication for choledochotomy. The incidence of retained calculi in this study was 5.9 per cent. The length of time a tube remained in the ducts depended on the findings during the operation. Calculi were found in 190 instances.

Table I shows the complications following choledochotomy in 439 cases. Table II shows the indications for choledochotomy in 61 cases with nonpalpable calculi. RICHARD J. BENNETT, JR., M.D.

**Some Experiences with Anastomosis of the Common Bile Duct to the Duodenum, and Repair of Strictures of the Common Bile Duct.** M. M. ZINNINGER. *Surgery*, 1948, 23: 337.

Thirteen cases of anastomosis of the common duct to the intestine or repair of a stricture of the common duct are reported. In 4, the relatively normal duct was used in making the anastomosis, but in the remaining 9 a duct injured at a previous operation was used. In 10 of the cases the last operation performed was some type of anastomosis of the hepatic or common duct to the duodenum without the use of a defunctionated loop, and in 7 of these the result has been entirely satisfactory. Two of the patients succumbed to cancer within a year of surgery and the remaining 5 were well from 2½ to 6 years after operation. Three patients of the 10 did reasonably well over a period of from 2½ to 3½ years after operation, but had attacks of chills, fever, and jaundice.

In 3 cases of the original 13 a satisfactory result was obtained, with end-to-end suture of the duct, for 3½, 5, and 8 years, respectively, after operation.

Based upon his experience with these cases, the author makes several observations pertinent to the surgery involved. He believes that a Roux "Y" procedure with a defunctionated loop of jejunum anastomosed to the common duct is the procedure of choice when simple end-to-end anastomosis of the duct cannot be accomplished. However, his success with this group of cases supports his statement that simple choledochoduodenostomy is a valuable procedure in patients unable to stand the more extensive surgery necessary in a Roux "Y" procedure.

Several points in technique and management are emphasized. First, the obvious necessity of returning these patients to physiologic and nutritional balance before surgery is attempted is stressed. Vitamin "K" in large doses is a necessity.

Locating the proximal end of the common duct is enhanced by sharp dissection close to the under surface of the right lobe of the liver and approaching the hilum from the anterior and to the right. The bulbous end of the common duct appears as a bluish-tinged cystlike structure shining through the scar tissue. The distal end can almost always be found by mobilizing the duodenum, and reflecting it to the left to pick up the retroduodenal position of the duct.

Vitallium tubes are difficult to keep in place for long periods of time and tend to plug with biliary concretions, and, therefore, they are probably inferior to either a fenestrated catheter or a "T" tube which can be securely held in place and removed when desirable.

Mucosa-to-mucosa anastomosis is more desirable, even if there is slight biliary leakage, than is serosa-to-serosa anastomosis. The latter is liable to lead to stricture if epithelium partly lines the anastomosis.

FREDERICK C. HOEBEL, M.D.

**Surgical Treatment of Carcinoma of the Ampulla of Vater and the Extrahepatic Bile Ducts.** VINTON E. SILER and MAX M. ZINNINGER. *Arch. Surg.*, 1948, 56: 199.

Treatment of cancer of the ampulla of vater and of the extrahepatic bile ducts is often delayed in the attempt to make a correct clinical diagnosis. Since the problem of diagnosis and treatment may be considered the same for the two conditions, accurate clinical diagnosis is not as important as early diagnosis of a suspected cancer in this region, followed by prompt exploration. Only when this principle is followed will the resectability and cure rate improve.

The experience with these cancers during the 10 year period from 1937 to 1946, during which time 31,935 patients were admitted to the surgical service

of the Cincinnati General Hospital, is reported. Both cancers are rare.

Carcinoma of the ampulla of vater constitutes about 1.13 per cent of all cancers in autopsy statistics. Eight cases were observed at the Cincinnati General Hospital during the 10-year period, a clinical incidence of 0.027 per cent. The average age was 57.2 years. Six occurred in males, a sex incidence of 3 males to 1 female. The average life expectancy in untreated cases after the onset of symptoms is from 3 to 8 months, with death resulting from liver damage.

The important findings which lead to a working clinical diagnosis of carcinoma are: (1) persistent epigastric discomfort or pain, (2) anorexia and weight loss, (3) obstructive jaundice, (4) anemia of secondary type, (5) persistent occult blood in stool, (6) blood in duodenal secretion, and (7) roentgenologic evidence of a filling defect or "reversed 3 sign" in the periampullary region.

Pain, although a characteristic symptom, is of no definite type. The persistence of occult blood in the stool is regarded of major importance. The differential diagnosis can be established only by exploration.

The treatment of choice is partial duodenopancreatectomy. Whether operation is a one-stage or two-stage procedure must be left to the judgment of the surgeon in the individual case. Among the 8 cases the resectability was 50 per cent. One patient is living after 2 years and 10 months; another lived 7 years and then died of metastatic melanoma of the skin.

Ten cases of carcinoma of the extrahepatic bile ducts were seen in the 10-year period, a clinical incidence of 0.056 per cent. Autopsy statistics indicate the incidence of these lesions to be about 0.13 per cent of all carcinomas. The average age of the patients seen was 61.5 years, with a sex ratio of 3 males to 2 females.

The differential diagnosis is the same as for ampullary lesions. Pain radiating through the back is helpful in early diagnosis. Partial choledochoduodenopancreatectomy is the most desirable operative procedure when possible.

Eight of the 10 patients were explored. Six were inoperable; in 1 patient palliative operation (first-stage Whipple) was possible, and in another radical resection was done. The latter lived 1 year and 5 months; none of the others lived longer than 3 months after exploration.

Ampullary carcinoma has a higher resectability rate than does carcinoma arising from the extrahepatic bile ducts. FRANK B. QUEEN, M.D.

**Phlebothrombosis Associated with Mucin-Producing Carcinomas of the Tail and Body of the Pancreas: A Clinicopathologic Study of 2 Cases with Necropsy.** W. K. JENNINGS and WILLIAM O. RUSSELL. *Arch. Surg.*, 1948, 56: 186.

Contrary to cancers in other sites, pain is one of the earliest and most reliable symptoms of cancer of the body and tail of the pancreas, and upper abdominal pain constitutes the most frequent complaint in this condition. Three types of pain have been described as "typical" of this disease: (1) dull, aching pain often referred to the back, (2) paroxysmal pain at the umbilical level, often referred to the back, and (3) right upper quadrant pain resembling that in biliary colic.

Venous thromboses are also reported as being frequently associated with cancer of the body and tail of the pancreas (up to 56 per cent in autopsy series). In several instances the symptoms of peripheral venous thrombosis constitute the patient's initial complaint. It may be that unaccountable phlebothrombosis will prove an early clue to the existence of pancreatic carcinoma.

Two cases of mucinous carcinoma of the tail and body of the pancreas with multiple venous thromboses involving both the portal and systemic systems are reported in support of the observations reported. In one, pain was the first symptom; in the other, it was unexplained phlebothrombosis of the leg. Since no adequate explanation for the multiple thromboses was revealed by autopsy in either case, some yet unidentified property of mucinous carcinoma of the pancreas is postulated as possibly being associated with thrombosis in these patients.

FRANK B. QUEEN, M.D.

**A Technique for Pancreatoduodenal Resection.** RICHARD B. CATTELL. *Surg. Clin. N. America*, 1948, 28: 761.

The author considers four findings a contraindication to pancreaticoduodenal resection: (1) distant metastases, (2) local spread with direct invasion beyond a possible limit of resection, (3) involvement of the superior mesenteric vessels, and (4) involvement of the portal vein. The involvement of the superior mesenteric vessels can be determined by division of the gastrocolic omentum and incision of the peritoneum on the inferior border of the pancreas. Similarly, the portal vein can be identified by division of the gastroduodenal artery and displacement of the common duct downward, which permits digital examination of the posterior surface of the head of the pancreas by displacing the portal vein backward.

The author prefers a two-stage procedure. At the first stage an anticolic cholecystojejunostomy is done. If the lesion cannot be resected an enteroenterostomy is also performed. Also, in nonresectable cases a side-to-side anastomosis is made between the pancreatic duct and the jejunal loop, over a T-tube when possible.

The second stage of the procedure is carried out by reopening the first incision and lengthening it. The previous anastomosis is freed up and displaced to the right and downward. The peritoneum over the kidney is incised to the right of the duodenum, and the duodenum and head of the pancreas are elevated and rotated to the left. This will expose on the posterior aspect of the abdomen, in turn, the spermatic or ovarian vein, the inferior vena cava, and the aorta.

The lesser omental sac is entered through the anterior two layers of the gastrocolic omentum at the extreme right margin. The posterior portion of the gastrocolic omentum is then displaced downward, which permits identification of the middle colic vessels, the peritoneum is incised to the right, the hepatic flexure and right half of the transverse colon are freed and displaced downward. The peritoneum is then incised at the inferior border of the pancreatic body to expose the superior mesenteric vein. The superior mesenteric artery is next identified and the inferior pancreatoduodenal artery is ligated and divided.

The lower half of the gastrohepatic omentum is incised, the right gastric artery ligated and divided, and the course of the hepatic artery determined. The gastroduodenal artery is identified where it leaves the hepatic artery. It will be found to have a very short trunk before it divides, usually into four branches. This allows about 1 centimeter of the artery to be dissected free and divided between ligatures.

The common duct is then freed up and the site of entry of the cystic duct exposed. The common duct is displaced downward and the anterior surface of the portal vein visualized. A finger can be passed under the head of the pancreas on top of the portal vein, which has no branches, and the finger is passed through so as to emerge below the body of the pancreas and anterior to the superior mesenteric vein. Careful palpation of the entire region can at this time determine the operability of the lesion before division of either the stomach or common bile duct.

The common duct can now be divided between clamps at the proper point. This will vary greatly according to the site of the malignancy. If the first-stage operation has been done and the cystic duct found too close to the desired point of resection, the common duct is severed and left for implantation into the jejunum beside the cholecystojejunostomy. In rare instances it will be found necessary to remove the gall bladder and disconnect the cholecystojejunostomy. In the two-stage procedure when the cystic duct is not near the point of division, the common duct is carefully turned in by inversion sutures with silk for the outer layer.

The pyloric end of the stomach is then freed of its vessels and clamps are placed across it, usually from 1½ to 2 inches (3.7 to 5 cm.) proximal to the pylorus. The proximal clamp on the stomach can be placed within the abdominal cavity on the left side of the abdomen which leaves the entire anterior surface of the body of the pancreas exposed.

The body of the pancreas is now lifted up on the finger and a point selected for transection. The main arterial blood supply of the pancreatic body runs along the superior and inferior aspects as longitudinal pancreatic arteries. Suture ligatures are placed on both superior and inferior aspects of the pancreas with nonabsorbable suture material to enclose about 1 centimeter of the pancreas. These are used in the distal portion of the pancreas near the line of resection. The pancreas is then transected, bleeding from the proximal side being controlled with Allis clamps. The duct of Wirsung is dissected out before division is completed and left to project from the cut surface of the pancreas. This division exposes the portal vein and the junction of its tributaries, the superior mesenteric and splenic veins. The pancreas is then closed with interrupted mattress sutures of silk, the duct of Wirsung being left open. If the duct is dilated, a catheter of appropriate size is placed in it; if the duct is small, it is ligated with fine plain catgut and then transfixed behind the tie by passing a braided silk suture halfway through it. The portion of the pancreas remaining is displaced to the left.

The transverse colon is raised and a point selected for division of the jejunum about 7.5 cm. distal to the ligament of Treitz. The ligament of Treitz is completely severed, and the proximal jejunum and fourth portion of the duodenum are freed. The mesentery of the proximal jejunum is then divided and the vessels are ligated. The jejunum is divided between clamps and the proximal end is closed, the sutures being left long for traction.

The division of the ligament of Treitz, which frees the proximal jejunum beneath the superior mesenteric vessels, makes a free communication between this area and the dissection previously carried out on the right side of the abdomen. The proximal jejunum and the fourth portion of the duodenum are drawn through beneath the superior mesenteric vessels to the right. By elevation of the duodenum and head of the pancreas, the uncinate process can be freed up posteriorly. This is the most difficult part of the operative procedure.

After elevation of the pyloric end of the stomach, head of the pancreas, and duodenum, the short branches of the superior mesenteric vein and superior mesenteric artery which go to the head of the pancreas, the uncinate process, and the fourth and third portions of the duodenum are then divided between clamps, which permits delivery of the specimen. Sheets of gelfoam or oxidized cellulose (oyxcel) may be useful in the control of capillary ooze.

A point is then selected on the afferent loop of jejunum for the anastomosis of the pancreatic duct. If the duct is small, a pressure necrosing suture technique is used. Usually the duct of Wirsung will be large enough to permit careful suture over a rubber tube. The amesenteric surface of the jejunum at the point selected is incised for the same distance as the width of the cut closed end of the pancreas. The jejunum is sutured to the pancreas with interrupted silk sutures passing through the area previously closed by the mattress sutures of the pancreas to prevent the sutures from pulling out. When the posterior suture line has been completed, the mucosa of the jejunum is opened and two interrupted sutures of catgut are taken between the mucosa of the duct and the mucosa of the jejunum. A rubber tube is then inserted and anchored with a silk suture. Two interrupted sutures are taken in the mucosa anteriorly and the anastomosis is completed by interrupted

silk sutures through the anterior wall of the jejunum and pancreas.

In the two-stage procedure, the biliary-tract anastomosis will have been completed by the first stage cholecystojejunostomy. In some cases it will be necessary to implant the common bile duct into the jejunum as an end-to-side procedure just proximal to the gall bladder. This is the same anastomosis as carried out in the one-stage procedure, and is done in two layers over a rubber tube.

If the enteroenterostomy was not done proximal to these anastomoses in the first-stage procedure, it is done as the third anastomosis. The final procedure is an end-to-end anastomosis of the stomach to the jejunum.

A cigaret drain is placed down to the resected uncinate process and brought out between the biliary and pancreatic anastomoses through the upper portion of the wound. EARL O. LATIMER, M.D.

**Total Pancreatectomy.** JOHN M. WAUGH. *J. Am. M. Ass.*, 1948, 137: 141.

Radical resection of the head of the pancreas and of the duodenum had been done 49 times at the Mayo Clinic up to January 1, 1947. Eleven operations were for benign disease and 38 for malignant lesions. Six patients underwent total pancreatectomy, with 1 death in the hospital.

The indications for resection of the head of the pancreas and total pancreatectomy for benign disease are discussed, and it is emphasized that in such instances resection should be carried out only after careful evaluation of both the operative risk entailed and the disturbances in metabolism which might be expected.

Resection for carcinoma was accompanied by an operative mortality rate of 21 per cent. In the future this figure should become lower, for already one-stage resection for carcinoma of the head of the pancreas has been performed 15 times with a hospital mortality rate of only 13 per cent.

A follow-up study of the 30 patients who had undergone resection for malignant processes prior to January 1, 1946, and had survived operation, showed that 3 of 14 who had had carcinoma of the head of the pancreas and 5 of 8 who had had carcinoma of the ampulla of Vater were still alive on that date. The authors state that, other than surgical treatment, there is no therapeutic measure available which gives these patients any chance for cure; hence, attempts should be constantly made to lower the operative mortality rate for the procedure and to improve diagnostic acumen, so that resection can be carried out more often while the carcinoma is still in a curative stage.

**Principal Indications for Splenectomy during Childhood.** GEORGE VAN BUREN and GEORGE M. CURTIS. *Arch. Surg.*, 1948, 56: 125.

The principal indications for splenectomy in childhood are thrombocytopenic purpura, congenital hemolytic icterus, and Banti's syndrome.

The presenting symptoms of 22 children with thrombocytopenic purpura were subcutaneous ecchymotic or petechial hemorrhages (91 per cent), bleeding from the mucous membrane (73 per cent), a history of bruising easily (32 per cent), and weakness (9 per cent). The results following splenectomy in this group of children have been outstanding.

Congenital hemolytic icterus is a chronic blood dyscrasia characterized by a microcytic anemia, increased red cell fragility, reticulocytosis, acholuric jaundice, and splenomegaly. Occasionally, "crises" occur. The presenting symptoms of 20 children with this disease were jaundice (70 per cent), weakness (40 per cent), pallor (35 per cent), splenomegaly (30 per cent), nausea and vomiting (10 per cent), chills and fever (10 per cent), and abdominal pain (5 per cent). In the critical state, emergency splenectomy is the procedure of choice.

Splenectomy for Banti's syndrome is most successful if carried out in the early stages of the disease. EDWARD W. GIBBS, M.D.

**Spread of Carcinoma to the Spleen: Its Relation to Generalized Carcinomatous Spread.** JOHN W. HARMAN and PAULO DACORSO. *Arch. Path.*, Chic., 1948, 45: 179.

The authors studied the spread of carcinoma to the spleen, and its relation to generalized carcinomatous spread. They studied only those cases of carcinoma in which there were secondary growths in one or more viscera within the thoracic and abdominal cavities regardless of the primary source. This eliminated the cases of carcinoma without metastases and those with regional spread only, as well as cases of direct extension. Thus, only 30 of 116 cases of carcinoma collected from a total of 608 autopsies performed in the years from 1945 to 1947 at the University of Wisconsin Medical School Hospital, Madison, met the projected requirements.

In addition to routine autopsy examination, attention was paid to the spleen which was studied extensively, grossly, and microscopically. The criterion of Warren and Davis laid down in 1934, which regarded all noncontiguous masses of tumor cells as metastases, was adhered to by Harman and Dacorso. The pancreas was also examined specifically for secondary new growths, because its arterial supply is associated with that of the spleen, and because the pancreas is regarded as a rare site of metastases. Both organs derive their principal arterial supply from the same branch of the celiac axis, which would permit an equal chance of receiving hematogenous tumor emboli—a circumstance that might reveal any particular resistance of the spleen if there were a discrepancy in incidence. A special analysis of carcinomas of the stomach and the pancreas showed no peculiar propensity of these neoplasms to invade the spleen through the venous drainage system.

The authors found that in 30 cases of carcinoma in which metastases occurred in one or more organs in more than one body cavity, the incidence of splenic and pancreatic metastases was 50 and 43

per cent, respectively. In no instance were splenic metastases found apart from generalized spread in the gastric and pancreatic cases. The low occurrence of splenic metastases as compared with metastases in lymph nodes, liver, and lungs was due to inequality of exposure to metastases. When the exposure was equalized, the spleen was not less susceptible than other viscera. ROBERT TURELL, M.D.

## MISCELLANEOUS

**Ligation of the Splenic Artery in Patients with Portal Hypertension.** TILDEN C. EVERSON and WARREN H. COLE. *Arch. Surg.*, 1948, 56: 153.

The operation of portacaval shunt for the relief of portal hypertension is a successful procedure for the good risk patient. However, many patients are poor operative risks for such a formidable procedure. For the latter group the authors recommend ligation of the splenic artery.

Following ligation of the splenic artery in patients with portal hypertension, there is an appreciable decrease in the size of the spleen but no evidence of necrosis. The veins transporting blood from the spleen are not disturbed and serve as channels for the escape of portal blood. The technique is simple. Three successful cases are reported in detail.

EDWARD W. GIBBS, M.D.

**Absorption of Blood from the Peritoneal Cavity.** CLAUDE R. SNEAD. *Arch. Surg.*, 1948, 56: 249.

Investigation shows that surgeons differ concerning the advisability of removal of fluid blood and clots from the peritoneal cavity after intraperitoneal hemorrhage or operative procedures. The purpose of the experiments was to determine the fate of blood introduced into the peritoneal cavity, its possible usefulness as a substitute for transfusion on occasions when the usual methods are inapplicable or too difficult, and its effect on the blood volume, hematocrit reading, hemoglobin, and total protein levels. Additional observations were made to determine if the clinical leucocytosis so frequently observed after intraperitoneal hemorrhage is due to the hemorrhage alone or to the mere presence of blood within the peritoneal cavity. The response of the peritoneum itself to repeated intraperitoneal injections of autogenous blood was also determined.

A review of the literature concerning peritoneal absorption prior to 1923 was written by Cunningham. The method of administering blood by the intraperitoneal route as a means of transfusion or as a preventive measure against peritonitis or adhesions has been studied by many investigators. Some authors concluded that the presence of blood in the peritoneal cavity had no effect on the development of peritonitis, while others reported that blood in the peritoneal cavity after abdominal operations offered protection against peritonitis and adhesions.

An increase in hemoglobin and in the erythrocyte count has been reported previously after the injection of blood into the peritoneal cavity, but the response of the blood volume to hemoperitoneum has not been investigated.

Blood injected intraperitoneally is more rapidly absorbed if it is kept liquid by the use of an anticoagulant. Citrated blood is completely absorbed within 24 hours after injection. When uncitrated blood is injected, clots from 0.5 to 8 cm. in size are observed at 4 days but are absorbed within 9 days after injection. Absorption of blood by way of the peritoneum will raise the blood volume to a maximum in 24 hours when 36 c.c. per kilogram of body weight are injected in dogs. The leucocytosis following hemorrhage into the peritoneal cavity is in some way due to the presence of blood in the peritoneal cavity itself and is not accounted for on the basis of leucocytosis caused by hemorrhage. Moderate peritoneal thickening, omental fibrosis, and mesothelial proliferation without adhesions follow repeated intraperitoneal injections of citrated autogenous blood.

HARRY W. FINK, M.D.

# GYNECOLOGY

## UTERUS

**Studies of the Uterine Mucosa.** BERTIL FALCONER. *Acta obst. gyn. scand.*, 1948, 27: 339.

The author advocates that the various cyclic endometrial phases of the uterine mucosa be grouped as follows: (a) desquamation, (b) postmenstrual, (c) early proliferative, (d) late proliferative, (e) transition from the proliferative to the secretory phase, (f) secretion-preparedness, (g) midsecretion, (h) late secretory, and (i) premenstrual.

The menstrual or desquamation phase is characterized by (a) endometrial breakdown, hemorrhage, and cell infiltration, (b) signs of secretory activity on the part of the epithelial glands, and (c) swollen cells of the stroma showing regressive changes. The diagnosis may not always be easy and the hemorrhages must be differentiated from those from other causes.

The postmenstrual phase overlaps the first week of hemorrhage, thus partly also overlapping desquamation. This is one of the stages in which the histological pictures present the greatest difficulty for diagnosis. This is true also in the transition stages between the proliferative and secretory phases, and at the stage of desquamation.

The early proliferative phase continues approximately to the tenth day of the cycle; its transition from the postmenstrual phase is ill defined.

The late proliferative phase is characterized by a thick uterine mucosa containing corkscrew-shaped glands, the lumina of which are narrow and lined with an epithelium in which mitoses are scant, and the edematous stroma is made up of stellate cells and coiled arterioles. It lasts to the fourteenth or sixteenth day of the cycle.

Transition from the proliferative to the secretory phase does not seem to last longer than 2 days. It probably occurs during the fourteenth to sixteenth days of the cycle. At this time ovulation takes place and the effect of luteinization becomes manifest. This is the time that "Mittelschmerz," or "intermenstrual pain," may occur with hemorrhage into the endometrium.

The early secretory phase or secretion preparedness is characterized by enlargement and tortuosity of the corkscrew-shaped glands, vacuolation of the epithelium, predominantly in the basal zone, edematous stroma, and coiled arterioles. This phase continues to the eighteenth or nineteenth day of the cycle and is followed by the beginning of genuine differentiation.

Midsecretion is a term introduced by American workers. It occurs approximately during the eighteenth to twenty-fourth days of the cycle. Genuine functional development of both glands and the stroma begins. Tortuosity of the glands becomes more marked, and there is definite evidence of secretory glands. The stroma begins to develop.

In the late secretory phase the specific changes of the glands and stroma become more marked. The glands assume a saw-tooth appearance. The stromal cells continue to accumulate nutrient substance and the arterioles become markedly coiled.

The premenstrual phase seems to begin only during the last 24 hours of the cycle. It is the transition stage to desquamation, a piecemeal affair, which is characterized by crumbling and rapid necrosis of the endometrium, and hemorrhage.

In analyzing curettage material the pathologist should concentrate his efforts on establishing the endometrial phase as exactly as possible, not being content merely with diagnosis of the proliferative or secretory phase. On the other hand, a diagnosis of, for instance, "endometrium in the twenty-third day of the cycle" is not reasonable in practice. This diagnosis is based on the assumption that the menstrual periods occur regularly every 28 days, which is rarely the case. T. FLOYD BELL, M.D.

**Hysterography as a Diagnostic Aid in Submucous Myoma.** STIG ERIKSON AND HENRY JEDBERG. *Acta obst. gyn. scand.*, 1948, 27: 367.

A brief history of hysterography is given. It reveals the difficulty in the making of satisfactory hysterograms until the introduction of contrast media soluble in water, which event increased the diagnostic value of hysterography.

In describing the method, the authors emphazise the importance of avoiding contrast media which are too opaque, otherwise minute structures may be concealed. The examination should be made under the fluoroscope. Several cases are reported and illustrated by figures.

The roentgenographic appearance of submucous myomas varies widely. However, they have one feature in common, i.e., a filling defect, which is regular in outline. Its shape varies with its size, the degree to which it projects into the uterine cavity, and the extent to which it is attached to the uterine wall.

In the differential diagnosis, polyps of the endometrium are most important. The latter present an irregular shape, and an uneven surface; they accommodate their growth to the shape of the uterine cavity, and offer little difficulty in diagnosis. Firm polyps may be difficult or almost impossible to differentiate from myomas, particularly if the latter are pedunculated.

Hysterography should be done in the first half of the menstrual cycle. However, if the contrast medium flows too rapidly through the uterus and tubes into the abdominal cavity to permit the making of satisfactory roentgenograms, another x-ray study should be made at a later stage in the cycle.

In cancer of the uterus the hysterogram reveals a uterine cavity with frayed and irregular contours and a defect in its filling.

The authors believe this method is a valuable diagnostic aid in submucous myoma and that it should be included in the routine examinations.

T. Floyd Bell, M.D.

## ADNEXAL AND PERIUTERINE CONDITIONS

**A Contribution to the Study of Suppurating Dermoid Cysts of the Ovary with an External Fistula** (Contributo allo studio delle cisti dermoidi ovariche suppurate e fistolizzate alla parete). Giovanni D'Errico. *Gior. ital. chir.*, 1948, 4: 99.

Although cases of suppurating dermoid cysts of the ovary with an external fistula are exceptional, D'Errico has observed 2 at practically the same time. The first patient, a woman of 59, had had an acute abdominal syndrome 20 years previously, characterized by pain in the left flank and moderate fever; she was operated upon after 8 days and a quantity of pus mixed with hairs was evacuated. It is most probable that the symptoms were due to an acute inflammation of the cyst rather than to a torsion of its pedicle. Fistula formation following the intervention represented the natural evolution of the process, as suppuration continued because the cyst was not removed. Four years ago the patient was reoperated upon to free her from the fistula, but the intervention failed because nothing was done about the cyst. Finally, she came to D'Errico's clinic where the cyst and fistula were successfully removed.

The second patient, a woman of 52, had developed digestive disturbances 5 years ago, and a diagnosis of cyst of the right ovary was made 3 years later. She had persistent fever which was attributed to suppuration of the cyst. She was operated upon, but the surgeon did not succeed in removing the cyst because of adhesions, and he limited himself to opening and draining it. The natural result was a fistula, through which some hair was eliminated about 5 months later. At D'Errico's clinic the cystic mass with scars and fistula was successfully excised. However, on the seventh postoperative day the patient developed an abscess in the right iliac fossa and fever which persisted after opening of the abscess and which resisted treatment for about a month, then disappeared suddenly on the occasion of anaphylactic shock caused by the intravenous injection of antiperitonitis serum.

An interesting occurrence in this case was the elimination of a living ascaris through the incision in the right iliac fossa, without any sign of peritoneal irritation or formation of intestinal fistula. This could be explained by an adhesion of the bottom of the incised abscess to one or more intestinal loops through which the ascaris could have made its way to the exterior without passing through the peritoneal cavity. The absence of intestinal fistula formation could be due to the small diameter of the worm (about 2 mm.) and to the thickness of the tissues separating the bottom of the abscess from the intestinal lumen and the varying consistency and structure which allowed spontaneous closure of the small break in the intestinal wall.

In both cases histologic examination of the removed mass confirmed the diagnosis of suppurating dermoid cyst established preoperatively on the basis of expulsion of hair through the fistulas.

Richard Kemel, M.D.

**Considerations on the Krukenberg Type of Ovarian Tumors** (Considérations sur les tumeurs ovariennes type Krukenberg). P. Sarbu, V. Vasiliu, and E. Mestes. *Gyn. obst.*, Par., 1948, 47: 178.

A woman of 36 was admitted with an abdomen the size of a full-term pregnancy. She complained of respiratory disturbances, loss of weight, difficulty in walking, and amenorrhea. Six months previously she had been operated upon for an inoperable tumor of the stomach with pyloric stenosis, for which a gastroenterostomy had been performed. The amenorrhea had started a month before this operation and the abdomen had begun to increase in size shortly after the operation. Examination disclosed ascites and a hard, knobby, fixed tumor which reached under the costal margin and into the pelvis. Exploratory laparotomy revealed 2 tumors without adhesions: one involved the right ovary and was the size of a child's head; the other came from the left ovary and was the size of a large orange. Both were easily removed. Examination of the upper part of the abdomen showed the pyloric tumor surrounded by an epiploic mass. The abdomen was closed without drainage. Roentgen treatment was followed by slight amelioration of the general condition, but this did not persist because the gastric disturbances returned gradually. Histologically, the tumors presented adenocarcinomatous formations of gastric type and Krukenberg's signet ring cells in a sarcomatoid stroma.

All authors now agree in considering this ovarian tumor as a metastatic localization of a tumor of the breast, the biliary tract, the colon, or the stomach, especially of the last. Disagreement starts with discussion of the route by which the ovary is involved, and the circulatory, retrograde lymphatic, and transperitoneal routes have all had their supporters.

The histologic characteristic of these tumors is the presence of signet ring cells and of pseudoglandular formations of digestive type in a sarcomatous mass. The particular aspect of these epithelial cells is due to compression by the surrounding sarcomatous tissue. The presence of mucus and the mucicarmine reaction are not pathognomonic because mucous degeneration characterizes the evolution of most carcinomatous cells. The frequency of Krukenberg tumors among the solid tumors of the ovary is relatively high. From 20 to 25 per cent of the solid ovarian tumors are metastatic. The Krukenberg type of ovarian tumors is malignant despite the false impression of benignancy imparted by its mobility at operation. Malignancy of the tumor can be accepted in the presence of ascites, bilaterality, cachexia, and associated metastasis, whether peritoneal, epiploic, or of other type.

Most authors recommend extirpation of the tumors followed by total hysterectomy and roentgen therapy; some oppose surgical intervention claiming that extirpation of the metastases stimulates the primary tumor; the present case seems to confirm this opinion.

Present knowledge of Krukenberg tumors suggests two practical considerations. Whenever hard bilateral ovarian tumors are found in the course of an operation, surgical and roentgen exploration of the digestive tract is indicated in search of the primary tumor. In view of the tendency of tumors of the digestive tract to metastasize, the question arises whether in gastrectomy for neoplasm it would not be advisable to extirpate the ovaries as a prophylactic measure, especially before the menopause.

RICHARD KEMEL, M.D.

## MISCELLANEOUS

**The Value of Celioscopy in Gynecologic Diagnosis** (Il valore della celioscopia nella diagnostica ginecologica). G. VECCHIETTI. *Quad. clin. ostet. gin.*, 1947, 2: 962.

Celioscopy or peritoneoscopy, introduced by Kelling in 1901, has been found by the author to be a valuable addition to the diagnostic armamentarium in gynecology.

The dangers of the method can be avoided by strict observance of the rules.

To explore the female reproductive organs, it is necessary to place the patient in Trendelenburg's position, and the uterus in anteflexion and elevation by means of an intrauterine probe.

The diagnosis by means of celioscopy was correct in 97.05 per cent of 70 cases in which the method was employed in the gynecologic clinic of Parma.

The method is of particular value for the diagnosis of ectopic pregnancy, follicular or corpus luteum cysts, inflammatory processes of the adnexa, genital malformations, and ovarian tumors.

If a small ovarian cyst or an accumulation of pus is encountered, an immediate injection of penicillin or sulfa drugs *in loco* avoids complications.

The insufflation should be done slowly, the intra-abdominal pressure should be measured with a manometer, and the injected gas should be sterile.

Of the different gases, oxygen is recommended because it is well absorbed and is nontoxic, but a danger is present when electrocautery is employed. The author uses Palmer-Solacs' celioscope. The use of the uterine probe is contraindicated in the presence of suspected or certain pregnancy, inflammatory or neoplastic changes of the endometrium, or imperforated hymen. The examination is performed under local anesthesia because a general anesthetic causes an abolition of reflexes so that the early signs of gas embolism, such as attacks of cough, may be suppressed. The celioscope may be introduced in the lower midline of the abdomen or through the posterior cul-de-sac, with the patient in the knee-chest position. The total amount of gas injected should not exceed from 3,000 to 5,000 c.c., not more than from 500 to 700 c.c. being injected per minute. The pressure should not exceed 20 to 25 mm. mercury.

As to contraindications, caution is advisable in the presence of cardiopathies, especially those involving the myocardium. According to some authors, the presence of acute inflammatory processes is considered a contraindication, but the writer found the method not only innocuous but extremely valuable in the differential diagnosis of appendicitis and acute salpingitis. The method should not be employed in the presence of a diaphragmatic hernia because a communication may exist between the peritoneal and pleural cavities. Hemorrhagic diathesis also forms a contraindication.

JOSEPH K. NARAT, M.D.

**Surgical Experience in 51 Cases of Genitoabdominal Tuberculosis** (Nuestra experiencia quirúrgica sobre 51 casos de tuberculosis génitoabdominal). C. FERNÁNDEZ-RUIZ. *Rev. españ. obst.*, 1948, 5: 13.

It is the author's belief that tuberculosis of the female reproductive organs is much more frequent than is generally assumed. He reports 51 cases in which the diagnosis was verified at the operation and ascertained histologically.

The ages of the patients ranged from 19 to 59 years. Twenty-two of the patients were in the third, 21 in the fourth, and 7 in the fifth decade of life, and 1 was older than 50 years. Forty patients were married and 11 were single. Of the 40 married women, 31 were sterile. The following symptoms were present in descending order of frequency: dysmenorrhea, leucorrhea, oligomenorrhea, and menorrhagia.

The correct diagnosis was made in 9 cases, or 17.6 per cent. Hysterectomy and removal of the adnexa were done in 25 cases, while various conservative procedures were employed in the remaining 26 cases. The postoperative mortality was 3.9 per cent. One patient who died had had an extensive suppurative peritonitis and the other had developed an exacerbation of his pulmonary symptoms.

In 8 cases suppurative peritonitis was present. In descending order of frequency, adhesive adnexitis, pyosalpinx, and obstructive nodular salpingitis were found. In 12 cases the uterus, tubes, and ligaments were involved.

A primary focus of infection in the lungs could be found only in 7 cases. In 2, Pott's disease was found, while in the remaining cases clinical and x-ray examinations failed to reveal the primary focus, which possibly was located in the abdominal lymph nodes.

Blood counts and determination of the sedimentation rate did not prove of any diagnostic value. The association of genital tuberculosis with other pathologic conditions of the same organs creates diagnostic difficulties. Fever in the past history should arouse suspicion. Amenorrhea in young persons should not be treated with hormones until a clinical and x-ray examination of the lungs has been done. Aggravation of dysmenorrhea by endocrine products justifies a suspicion of the tuberculous character of the condition.

The author's institute lacks an x-ray apparatus and therefore his treatment is exclusively surgical. The type of operation varies according to the condition from unilateral salpingectomy or oophorectomy to complete hysterectomy and removal of the adnexa.

In cases in which the process is very extensive, postoperative irradiation is advised by the author. Heliotherapy in the form of sunbaths is also a valuable therapeutic adjunct. JOSEPH K. NARAT, M.D.

**A Contribution to the Study of Endometriosis in Mexico** (Contribución al estudia de la endometriosis en México). MARIO MADRAZO BASAURI. *Gin. obst. Mexico*, 1948, 3: 13.

The author reports his work on endometriosis during the past 2.5 years as chief of a large gynecological service. He reviews the terminology and classifications of Sampson of the American school, and of Calatroni, in Argentina, who represents the German school.

The author is of the opinion and proposes that the classification of endometriosis should be (1) primary, for the lesions localized in the wall of the uterus and having anatomic continuity with the normal endometrium, and (2) secondary, for all lesions localized outside of the uterus and without continuity with the normal endometrium.

His statistics have been gathered from 1,483 laparotomies for gynecologic diseases. Thirty cases are listed statistically. The history, symptoms, pathology, diagnosis, and treatment of endometriosis are discussed.

It is to be noted that there were no deaths in this series, and no recurrences in the group, some of the cases having been followed for 2 years.

W. FOSTER MONTGOMERY, M.D.

**Surgical Treatment of Rectal Complications of Radiotherapy for Cancer of the Uterine Cervix; Possibilities of Sympathetic Surgery** (Traitement chirurgical des complications rectales de la radiothérapie pour cancer du col utérin. Possibilités de la chirurgie sympathique). M. DARGENT and L. EICHOLZ. *Lyon chir.*, 1948, 43: 199.

The serious rectal complications consist of the rectitis syndrome due to craterlike ulceration of the anterior aspect of the rectal ampulla 5 cm. above the anal canal, or to inflammatory stenosis with thickening of the entire rectal wall or its anterior half; the syndrome of established stenosis which is annular, fibrous, and generally well tolerated; and a rectovaginal fistula which may follow the phase of acute stenosis and is located from 4 to 6 cm. above the anal canal. These complications do not necessarily follow one another; although the more grave rectitis results in stenosis or fistula, there is annular stenosis which has developed insidiously. The complications may be associated with stenosis at the rectosigmoid junction or along the colon and lesions of the small intestine, or with neoplastic evolution in the rectovaginal wall, the rectal sheath and mucosa, or the lymph nodes.

Some of the rectal complications are due to technical deficiencies (turning of the colpostat, slipping of the intrauterine tubes, excessive roentgen treatment of the perineal area); others are due to radionecrosis of the pelvic tissues favored by infection and previous surgical trauma.

The authors found that the association of artificial anus and chemical or surgical section of the lower left sympathetic chain affords temporary or permanent relief to patients with grave perirectal syndromes, that an artificial anus alone is effective in 80 per cent of these patients, and that the formation of a rectovaginal fistula itself generally results in spontaneous disappearance of the pains. This raised the question whether the operation on the sympathetic chain alone would be sufficient and nullify the need for an artificial anus. Five serious cases in which unilateral or bilateral low lumbar sympathectomy was performed are reported.

Early results showed that this intervention had modified the threshold of pain but had not suppressed it completely. The passage of the old and hard fecal masses produced enough trauma to awaken the pain, but normal defecation even of very solid material did not cause pain subsequently. This sedation was demonstrated by digital examination of the rectum which became possible at the end of the first week and revealed definite softening of the walls. In 3 of the cases, a rectovaginal fistula formed from 5 days to 1 month after the operation and could be attributed only to the softening of the tissues. This was particularly clear in a case of pre-existing fistula which was obliterated by a cardboardlike block and exuberant granulations of rectal mucosa; it became manifest on the fifth day after the passage of feces.

Three months after the appearance of the fistulas the stenosis had completely changed: the exuberant granulations and the perirectal induration had disappeared and the fistulas opened onto a supple annular stenosis which admitted the index finger. Radical operation then was successfully carried out on the fistulas.

Evidently there are mixed radionecrotic and cancerous stenoses in which reversibility is out of the question and it is probable that in these cases sympathetic surgery may show a good temporary result, but an artificial anus will soon become necessary because of the inevitability of the pelvic blocking. To conclude, if observation of the patient reveals that low lumbar or retrorectal infiltration of the sympathetic chain is sufficient to obtain results, the surgeon must be satisfied with it and reserve surgery for the cases in which success is only temporary, the pains become intolerable, and intestinal obstruction occurs. RICHARD KEMEL, M.D.

**Torsion of Uterine Adnexa and Acute Abdominal Syndrome** (La torsione degli annessi uterini nel quadro dell' addome acuto). BRUNO PARISIO. *Clin. ostet.*, 1948, 55: 1.

Five cases of torsion of the normal female adnexa are reported. In 2 patients it occurred during preg-

nancy and in 3 after the period of pregnancy. In 4, the torsion occurred in the abdomen and in 1 within the sac of a femoral hernia. Two were located on the left, and 3 on the right side. In each instance the torsion produced very acute symptoms. In 1 case the diagnosis of the referring physician was extrauterine pregnancy; in another, abdominal colic of unknown origin; in the third, a strangulated left femoral hernia; and in the 2 last cases, acute appendicitis.

The gynecologic examination proved very valuable for the correct diagnosis.

In some instances of this type the torsion may subside spontaneously, or it may recur. Occasionally, a spontaneous amputation of the twisted organ may take place.

An early operation is indicated as soon as the diagnosis of torsion has been made.

As to the mechanism of torsion, the author believes that anatomic conditions serve only as predisposing factors and that the functional disturbance of nerves and blood vessels is mainly responsible for the occurrence of the condition.

JOSEPH K. NARAT, M.D.

**Meigs' Syndrome** (Le syndrome de Meigs). P. FUNCK-BRENTANO. *Gyn. obst.*, Par., 1948, 47: 150.

The author reports the case of a thin, tired, and dyspneic woman of 66 years, who had an effusion occupying half of her right pleural cavity and an ascites in which a large ovarian tumor floated. The diagnosis of Meigs' syndrome was made and confirmed at operation. The tumor, which belonged to the right ovary and weighed 500 gm., was removed and recovery was uneventful. The ascites did not reappear after the operation, and the pleural cavity, which had been punctured 2 days previously, did not contain any trace of fluid 11 days after the intervention. Histologically, the tumor was an ovarian fibroma with myxomatous changes and partial fibrinoid degeneration; its surface did not present the slightest vegetation capable of explaining the ascites.

Despite its relative rarity (46 published cases) the syndrome constitutes a clinical entity which should be well known. Systematic search for a pleural effusion in cases of ovarian tumor with ascites will aid in the diagnosis. The absence of blood or of tumor cells in the fluid obtained by pleural puncture will allow correcting the diagnosis of vegetating ovarian tumor with pleural metastasis which may have been made, and will completely change the prognosis. Of additional diagnostic interest is the fact that the pleural effusion occurs very frequently on the right side: among the 46 published cases, the hydrothorax was on the left side in 5, bilateral in 9, and on the right in 31. As often observed, the present case began with pleural effusion which, because of its tendency to recur, alerted the attending physician. The rapidity and abundance of its reproduction constitute an important sign of the syndrome.

The ovarian tumor is rarely the size of that found in the author's patient; it may not exceed the size of a nut and is then discovered only during the operation after the surgeon has evacuated the ascites.

The association of ascites with ovarian fibroma is frequent; it occurs in 50 per cent of the cases. This is far from the rarity of the syndrome of Meigs. The question arises why ovarian fibroma is accompanied by ascites while uterine fibroma is not? Some authors have attached a real pathogenic value to the secretion of the cubical epithelium which covers the ovarian fibroma. This theory is alluring but does not solve the second problem: why is the fibroma associated with ascites and hydrothorax? This association is not a coincidence; there is here a relation of cause and effect, as removal of the fibroma eliminates at the same time the ascites and the hydrothorax. Unfortunately, the pathogenic problem of the remote action of ovarian fibroma on the pleural serosa remains unexplained. RICHARD KEMEL, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Double Ectopic Pregnancy in One Tube.** DYRE TROLLE. *Acta obst. gyn. scand.*, 1948, 27: 395.

A case of double pregnancy in a single tube is presented. The patient had a fairly typical history of ectopic gestation although the diagnosis was somewhat difficult to make. Approximately 6 weeks after the onset of her symptoms, the diagnosis was affirmed by operation, at which time the right tube and a portion of the right ovary were removed.

On pathologic examination there was marked enlargement of the fimbriated portion of the tube with a small area of rupture. Microscopic examination confirmed the presence of a pregnancy in this area. The isthmus of the tube was likewise distended, but there was no evidence of rupture present. On microscopic examination this area was found to contain chorionic villi.

It is stated that there were approximately a hundred similar cases reported in the literature. Several factors might account for the difference in the size of the pregnancies, one being superfecundation, and another being the local conditions of growth which may permit one portion of the tube to grow more rapidly than another portion.

JAMES F. DONNELLY, M.D.

**Fifty-Four Deaths Occurring in Pregnant Patients Who Had Hypertension.** ROBERT A. ROSS, S. S. LAMBETH, W. L. THOMAS, and F. B. CARTER. *Am. J. Obst.*, 1948, 55: 591.

The authors' article is based on an analysis of charts and records (from Duke Hospital, Durham, North Carolina) of 54 patients who had blood pressures above 140/90, and who died during pregnancy or in the immediate puerperium. The purpose of this study was twofold: first, to select facts from the records which would be helpful in estimating the prognosis of similar cases in the future; second, to analyze and consider the different methods of management as a guide to future therapeutic approach in hypertensive patients.

The steady increase in the relative importance of hypertension in pregnancy as a cause for maternal mortality is in keeping with the increase in chronic vascular renal disease as a cause of death in the general population.

The elevated blood pressure was the one common denominator in all of the patients. Other factors varied considerably so that it was impossible to classify the exact pathologic process. The authors learned that no single factor is of great practical importance, and that the seriousness of the whole clinical picture should be considered in the management of hypertensive patients. They believe that help from all sources is important and the simpler laboratory tests are worth while.

The fate of the infant is a most important consideration in any pregnancy, and particularly so in pregnancies involving such sacrifices as those presented in the study. Only 17 of 58 infants survived the neonatal period, which is not a fair ratio for the risk of 58 (maternal) lives.

The hypertensive woman with an enlarged heart, albuminuria, and in whom changes in the optic fundi have occurred, has a poor prognosis when pregnant. Serious consideration of interruption of the pregnancy by the most conservative means should be given in such cases, regardless of the stage ot pregnancy, and contraceptive measures should be suggested.

JOHN R. WOLFF, M.D.

**Nonsegmentation of the Nucleus of Neutrophil Granulocytes in Toxicoses of Pregnancy** (Sull' insegmentazione del nucleo dei granulociti neutrofili nelle tossicosi gravidiche). UMBERTO BRACALE. *Arch. ostet. gin.*, 1948, 53: 31.

This study was made on 20 subjects, of whom 12 had eclampsia (10 during pregnancy and 2 in the puerperium), 6 pre-eclampsia, and 2 premature toxic detachment of the normally inserted placenta. In all patients before delivery a red and white blood cell count was made, as well as a differential count of the neutrophil granulocytes with segmented nucleus and nonsegmented nucleus, the eosinophils, mast cells, lymphocytes, and monocytes. In addition, in each formula the neutrophil coefficient of nuclear nonsegmentation of Mas y Magro was calculated by dividing the number of nonsegmented neutrophils by that of the segmented neutrophils, the normal value being between 0.05 and 0.06. Similar studies were made on the subjects 3, 5, 7, and 10 days after delivery.

The first fact observed was the increase of the nonsegmented forms with a Mas y Magro coefficient generally above normal; in only 6 cases were about normal values found. In pregnancy there is a leucocytosis and generally a deviation of the granulocytes to the left. Those who have studied the percentage variations of nonsegmented neutrophils during pregnancy have found differences ranging up to 10 per cent in the absence of puerperal complications. Therefore, it should be remembered that as a result of pregnancy itself there is an increase in the rate of nonsegmented neutrophils, the origin of which is probably connected with the leucocytosis of pregnancy. However, if in the picture of leucopoietic hyperactivity it is possible to explain an increase in the segmented forms, it is more difficult to interpret 4 cases in which persistent peripheral leucopenia was opposed to a progressive increase of the nonsegmented granulocytes. In addition, some segmented and nonsegmented granulocytes in 2 of these cases showed nuclear vacuoles and pyknotic chromatin condensation. Undoubtedly in these cases (eclamp-

sia in the puerperium) the blood picture indicates a myelotoxic condition with degenerative cellular damage of the maturating elements.

In other cases, besides the increase in the rate of nonsegmented elements, there was a leucocytosis which has remained nearly unchanged in successive examinations while the nonsegmented neutrophils decreased.

Only 3 cases presented very high rates of nonsegmented neutrophils with a Mas y Magro coefficient up to 0.97. These were cases of severe infectious complications in which the leucocytosis ran high. Therefore, the infective state, in addition to the toxicosis of pregnancy, must be taken into account. In these cases, 2 of which were subjected to vaginal intervention and 1 to cesarean section which was followed by a large suppurating hematoma, a massive introduction of immature elements into the circulation must be accepted rather than an inhibition of maturation by the toxicosis of pregnancy.

RICHARD KEMEL, M.D.

## LABOR AND ITS COMPLICATIONS

**Protrusion of the Acetabula as a Complication of Labor.** JENS PETERSEN. *Acta radiol.*, Stockh., 1948, 29: 205.

The author discusses the etiology of protrusion of the acetabula and presents a case in which this condition resulted in prolongation of the parturition and delivery in a 32 year old primipara. The course of the parturition, even for the patient's age, was rather protracted (about 45 hours). The roentgen examination revealed the fetus in cephalic position. The head showed evidence of accommodation and a rather large segment was seen below the pelvic inlet. There was bilateral distinct protrusion of the acetabula, with projection into the pelvic lumen of about 1 cm. on the right side and a little less on the left. The pelvic measurements (by the simple geometric method) were: anteroposterior diameter, 7.9 cm., right oblique diameter, 11.9 cm., left oblique diameter, 11.9 cm., transverse diameter, 13.1 cm., and the smallest distance between the acetabula, 10.2 cm.

The skull of the child revealed pressure traces which suggest that the protraction was due to protrusion of the patient's acetabula.

FRANK L. HUSSEY, M.D.

**The Fate of the Living Viable Babies in Extrauterine Pregnancies.** MAX SUTER and CELESTE WICHSER. *Am. J. Obst.*, 1948, 55: 489.

This article was written with the idea of determining, as nearly as possible from the limited clinical material available at the Charity Hospital of Louisiana, New Orleans, and from a survey of the literature, the fate of the viable babies delivered from extrauterine pregnancies. Only cases of infants born living after 28 or more weeks of gestation were selected.

Forty-one cases are tabulated from the literature to supplement those previously summarized. Four new cases of extrauterine pregnancies with living, viable babies are reported from the Charity Hospital of Louisiana. Their case histories are abstracted.

Only about one-fourth of all the extrauterine pregnancies diagnosed after the fifth month of gestation will result in viable, living babies. About one-third of all these living, viable babies will have major or minor deformities including those which were incompatible with life, and approximately half will survive 8 days or more.

JOHN R. WOLFF, M.D.

## PUERPERIUM AND ITS COMPLICATIONS

**Early Rising after Delivery.** EDWARD L. CORNELL AND JOSEPH J. MULLEN. *Am. J. Obst.*, 1948, 55: 768.

One thousand patients at the Henrotin Hospital, Chicago, Illinois, were allowed up on the sixth postpartum day or earlier. Eighty per cent of these patients were allowed up prior to the fifth day and 30 per cent were allowed up prior to the third day. Fifty-three of these patients had a cesarean section. The remainder had vaginal deliveries with the usual incidence of operative procedures.

These patients were apparently in much better condition at the time of discharge than if they had remained in bed for 8 or more days. The patients expressed a sense of well-being and a feeling of general good health earlier than those allowed to remain in bed for a longer period. They were in a position to adapt themselves more readily to their daily household routine.

Wound healing following episiotomy was not adversely affected, nor was the morbidity increased. Urinary retention did not occur in any case, and postpartum cystitis and pyelonephritis were at a minimum, 3 cases being established by clinical and laboratory methods. No case of thrombophlebitis occurred among the patients delivered vaginally. The rate of involution of the uterus was increased. No case of uterine prolapse occurred.

The postoperative course following cesarean section was more nearly uneventful. Distention was infrequent. The necessity for catheterization and enemas was lessened when the patient was up to the toilet on the first postoperative day. One case of thrombophlebitis occurred in this group.

The authors believe that early ambulation is of distinct benefit in the immediate postpartum period. When necessary, because of overcrowding, the patient may be discharged from the hospital earlier than heretofore, with a greater margin of safety. The authors express a caution as to the possible late gynecological complications of this early ambulation, such as prolapse and relaxation.

JOHN R. WOLFF, M.D.

**Immediate Postpartum Hemorrhage Due to Retained Secundines.** B. H. CARROLL, H. H. MEIER, and O. H. STONE. *Am. J. Obst.*, 1948, 55: 620.

Excessive blood loss in the third stage of labor is the forerunner and the cause of much of our maternal mortality and morbidity. The authors believe that

the most frequent cause of postpartum uterine bleeding is faulty separation or retention of parts of the secundines. The purpose of this article is to record the blood loss, the clinical course, and the treatment of 115 private patients in whom retained placenta, membranes, or both, was the cause of the hemorrhage. The method and apparatus used in collecting blood is described.

The customary method of estimation is notoriously deceiving and inaccurate. Accurate measurement of blood loss may be used as an early objective sign which sharply identifies the condition of the patient and also justifies early removal of retained tissues to control uterine bleeding. When 500 c.c. of blood have been collected, the patient is in the abnormal or danger zone, there being an associated increased number of clinical complications. With one exception the morbidity, mortality, shock, and need for chemotherapy occurred in patients who had lost more than 500 c.c. of blood. Moreover, blood loss over 500 c.c. was associated with a decreased ability of the mothers to nurse their infants.

Retained tissue was the cause of the immediate postpartum uterine hemorrhage in all of these cases. Early manual removal of this retained tissue permitted normal contraction of the uterus and arrested hemorrhage. The authors describe their method of manual removal of tissue. Manual invasion of the uterine cavity was not associated with a high incidence of morbidity. It is believed that infection is more likely to develop in cases in which retained pieces of tissue are left in the uterus.

A real and noticeable clinical response was observed when the blood loss was promptly replaced. Thirty-three per cent of the patients were transfused. It was the authors' opinion that more transfusions could have been given with benefit. The therapeutic action is both prophylactic and curative.

JOHN R. WOLFF, M.D.

**Motor Difficulties of Neurological Origin following Delivery** (Troubles moteurs d'origine nerveuse consécutifs à l'accouchement). J. BRET. *Rev. fr. gyn. obst.*, 1947, 42: 354.

After reviewing the French literature on nerve injuries occurring in pregnancy or following delivery, the author reports 3 such cases. All 3 patients had difficult forceps deliveries and upon awakening from anesthesia complained of pain in one or both legs. Neurological examination revealed pain, sensory nerve disturbances, muscle weakness, absent or impaired reflexes, and foot drop.

Paralyses of the type described have a sudden onset. As a general rule, the patient is anesthetized for an operative delivery. Upon awakening from anesthesia, she complains of weakness, although this may not be noted until she attempts to walk. These paralyses are the results of injury to the external popliteal nerve, the internal popliteal nerve, or the roots common to these two nerves.

The end-results are variable. In most cases recovery is favorable and rapid. In certain cases, however, convalescence is prolonged and weakness and foot drop may persist for years.

In these 3 cases and in those reported in the literature, prolonged labor, late engagement at the end of dilatation, and a difficult forceps delivery were the usual story. The author discussed the dangers of applying the posterior blade of the forceps at the level of the promontory.

Injuries to the lumbosacral trunk or to the nerve itself may result from prolonged pressure by the fetal head, mechanical injury by the forceps blade, pressure from extravasated blood, or compression by scar tissue.

The usual treatment consists of electrical stimulation and the administration of vitamin B. If a similar case should occur, the author intends to resort to rapid surgical intervention to decompress the nerve by incision of the pelvic aponeurosis.

CRAIG W. MUCKLE, M.D.

## NEWBORN

**Dry Gangrenes of the Newly Born** (Les gangrènes sèches du nouveau-né). L. CLEISZ AND J. BRET. *Gyn. obst.*, Par., 1948, 47: 204.

The authors report a case of spontaneous amputation of the two lower extremities which began during the immediate postnatal period and presented the following similarities with previous descriptions of cases and with classical concepts of the disease. The lesions were bilateral, the clinical evolution was toward elimination of the involved tissues and there was complete absence of deleterious repercussion in the general condition of the patient. However, the extent of the involvement was particularly serious as it ended in elimination of the two legs, while in other reported cases of involvement of the extremities the lesions often involved only the skin and part of the subjacent soft tissues, allowing attempts at surgical repair. The notable fact about the case was that the authors were able to observe the beginning and the partial regression of the primary lesions which appeared about 24 hours after birth when the base of the trunk, the prepuce, and the scrotum became the site of cyanotic plaques which disappeared later. In the lower extremities the cyanosis was localized to a segment having the form of a cuff below which there was absence of circulation with lividity but without cyanosis. The stage of phlyctena which was most frequently observed by other authors appeared only several days later in this case.

At about the same time the authors also observed 2 newborn infants with local loss of substance of the scalp which was in the course of healing at birth. These 2 cases seemed to present minor forms of the ulcerous disease with an intrauterine beginning, described by Ombrédanne and Lacassie.

The pathogenesis of these accidents is not clear. The classical role played by amniotic cords, so often incriminated, must be rejected, while an infectious origin is out of the question. Traumatism in the course of delivery has been accused without factual

basis. The most probable cause seems to be vascular impairment. The authors have made various sections of the eliminated segments of extremities and found discrete vascular lesions, dilated veins but no thromboses, intact arteries, and absence of the popliteal artery. In connection with the latter, it is possible that this arterial segment was missing congenitally, but then why should the disturbances have occurred only after birth? It would seem that the hypothesis advanced by Fèvre corresponds best to the observed facts: there may have been a primary local impairment of the capillaries with resultant local ischemia and a secondary extensive process. Perhaps an important role in these accidents should be attributed to the sympathetic nervous system.

RICHARD KEMEL, M.D.

## MISCELLANEOUS

**Maternal Measles, Mumps, and Chickenpox as a Cause of Congenital Anomalies.** M. J. FOX, E. R. KRUMBIEGEL, AND J. L. TERESI. *Lancet*, Lond., 1948, 1: 746.

The association between the contraction of rubella by the mother in early pregnancy and the development of congenital defects in the offspring is discussed. Gregg (1941) reported 78 such anomalies in Australia, and Swan (1943-1944-1946) reported 101 similar cases in Australia. Since then, many reports have accumulated.

The most common defects noted were cataracts, heart disease, deaf-mutism, and dental abnormalities. Others were microcephaly, microphthalmos, harelip, cleft palate, pyloric stenosis, spina bifida, mongolism, and nevi.

Swan (1944) suggested from his findings that 100 per cent of women contracting rubella in the first 2 months and 50 per cent contracting it in the third month would have defective children. These workers as well as others did not cite the number of women with rubella whose offspring had no congenital defects.

The question is raised whether other infectious diseases, particularly those due to a virus, may cause similar defects. Except for the work of Aycock and Ingalls (1946) with poliomyelitis, the authors found no report dealing with numerical probability of anomalies following maternal virus diseases other than rubella. Of 131 pregnancies associated with poliomyelitis which were studied by Aycock and Ingalls, 33 ended in abortion, miscarriage, stillbirth, or death of the infant shortly after birth. Of the remaining 98 children, one had clubfoot and another heart disease, their mothers having had poliomyelitis in the second and third months of pregnancy, respectively.

The present study was undertaken to determine the numerical probability of anomalies in children born of mothers who had measles, mumps, or chickenpox in pregnancy. These diseases were chosen because each is caused by a filterable virus, each is common, and in Milwaukee each is legally notifiable to the Health Department.

In the 4 years from 1942 to 1945, there were 18,817 cases of measles, 14,914 cases of mumps, and 26,353 cases of chickenpox, with the reports showing "Mrs." in 100 cases of measles, 356 cases of mumps, and 77 cases of chickenpox.

Public health nurses visited all of the patients who were available; many had moved because of the war or housing shortage. Only 54 per cent of the married women with measles, 70 per cent with mumps, and 68 per cent with chickenpox were located and interviewed. Dental defects were not included, and questionable degrees of mental retardation were not recorded. Such congenital abnormalities as cataract, deafness, heart disease, cleft palate, and harelip were specifically investigated. Each child reported to have a congenital defect was examined by one of the authors. Many defects were found to be acquired and not congenital, such as otitis media and rheumatic heart disease.

Of the married women, 346 had had 589 children before they contracted any of the three diseases; 6 of these children had congenital defects. These same women had 109 live children after recovering from their virus disease. Of this number, 33 had been born of pregnancies associated with one of the three virus diseases. The remaining 76 children had been born of pregnancies which had begun after the mother had recovered from one of these diseases. There were no anomalies among the 76 children.

The number of children born to mothers who did not have any of the virus diseases during pregnancy was 589 plus 76, or 665. Of this group, 6 had congenital anomalies, a "normal" incidence of 0.9 per cent.

Of the children born to 33 mothers with measles, mumps, or chickenpox during pregnancy only one had a congenital anomaly. There were no defects in 22 children born after the mother had had mumps, and none in 4 children born after the mother had had chickenpox. Of the 7 children born after maternal measles, one had a unilateral harelip.

In the case of mumps, 3 children were born after mumps in the first 2 months, and 7 after mumps in the third and fourth months with no defects. With chickenpox, none were born after the disease in the first 2 months and only 2 after the disease in the third and fourth months with no defects. The only anomaly in the series occurred after measles in the fourth month. The only child born following measles in the first 2 months had no anomaly. No anomalies occurred in 8 babies born of mothers having had measles, mumps, or chickenpox in the first 3 months of pregnancy.

The authors state that the development of anomalies in babies born of mothers who have had virus diseases in pregnancy deserves serious study because of the handicap these serious defects impose on the individual and the economic burden on the parents and the community.

From the reports of Fox and Borton (1946) and Aycock and Ingalls (1946) the numerical incidence of anomalies in 15 children born of mothers having rubella in pregnancy was 2, or 13 per cent. In another

series by the same authors 2 of 12 infants, or 17 per cent, had anomalies. In the authors' report, 1 child with an anomaly was found following 7 cases of measles in pregnancy, a rate of 14 per cent. The small series, the authors believe, offers no basis for statistical study, but does show the need of carefully conducted investigation.

The true numerical incidence is difficult to determine because the cases in which mothers with virus disease give birth to offspring with congenital defects are reported, whereas those in which these mothers do not have defective infants are not reported.

BYFORD F. HESKETT, M.D.

**Benign Trophoblastic Cell Proliferation.** C. G. TEDESCHI AND A. A. MATARESE. *Am. J. Obst.*, 1948, 55: 758.

Trophoblastic cells often invade the uterine wall in a normal pregnancy. Whenever this invasion occurs, two possibilities may be present: benign, trophoblastic cell hyperplasia, or a form of chorioepithelioma. Since the differentiation between these two conditions is based quite often on a matter of opinion rather than definite histologic criteria, needless radical treatment may be recommended, and many uteri are sacrificed needlessly.

In the differential diagnosis between benign trophoblastic cell proliferation and chorioepithelioma, it is believed that valid information can be obtained from the intimate structure of the cell type, mainly involved in the proliferative process. On the basis of cytologic criteria, two patients were treated in a conservative manner. The final outcome proved this judgment to be correct.

The distinction between this benign and malignant condition should be based not on the invasive character of the trophoblastic type structure, but entirely on the morphologic character of the malignant cell. JOHN R. WOLFF, M.D.

**Factors in the Treatment of Chorionepithelioma.** ALBERT W. HOLMAN and ELIZABETH H. SCHIRMER. *Am. J. Obst.*, 1948, 55: 629.

Confusion exists in the minds of many physicians with regard to the relation between hydatid mole and chorionepithelioma. This is due, in part, to vague and misleading pathologic classification. The authors believe that the classification of chorionepithelioma should be clarified, that the word "chorionepithelioma" should be discarded, and that "choriocarcinoma," grades 1 to 4, should be used to replace it. Choriocarcinoma is a malignant change of the trophoblastic tissue; both the Langhans' and syncytial layers may be involved.

Hydropic degeneration can occur in the chorionic villi of any pregnancy and is responsible for many abortions. For this reason alone the uterus should be curetted in every patient in whom a miscarriage occurs in the first trimester of pregnancy, and the curettings should be examined microscopically so that the early abortion of a hydatid mole will not be overlooked, and a beginning choriocarcinoma may not be unsuspected.

Every patient who passes a hydatid mole must be suspected of harboring a choriocarcinoma. After a woman has passed a mole, she should be curetted immediately and the curettings should be examined. Negative findings from curettage mean nothing, and the urine of the patient should be examined for chorionic gonadotropic hormones by the Friedman test at intervals, until a year has intervened since the passing of the mole.

The primary, the most frequent, and the cardinal symptom of both hydatid mole and choriocarcinoma is bleeding. Any bleeding during pregnancy or other signs of threatened miscarriage must cause the thought of hydatid mole to be borne in mind. Likewise, any bleeding following miscarriage or pregnancy must cause choriocarcinoma to be suspected.

The ultimate clinical diagnostic method for choriocarcinoma is the biologic pregnancy test and, if this test is positive 2 weeks following pregnancy or the passage of a mole, hysterectomy should be performed in the absence of palpable lutein cysts. Roentgen examination of the lungs should always precede hysterectomy for choriocarcinoma because pulmonary metastases are frequently present before they are suspected and, if recognized early, may be treated by roentgen radiation. The ovaries should be removed only when involved by the primary growth, or by metastases. The vagina and vulva should be examined carefully before hysterectomy is carried out because metastases to the vagina frequently occur very early. JOHN R. WOLFF, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY, AND URETER

**Unusual Case of Adrenal Carcinoma.** L. R. Broster and Jocelyn Patterson. *Brit. M. J.*, 1948, 1: 781.

The authors reported a case of adrenal carcinoma because it showed the general clinical appearance of typical group 1 virilism, and in the later stages manifested disturbances in the carbohydrate and steroid metabolism of a particularly striking order.

Furthermore, this case afforded an opportunity for the successful application of a newly devised urinary color test for distinguishing between adrenocortical carcinoma and marked adrenal hyperplasia. As a test of malignancy the potentialities would seem to be not less than those of such acknowledged diagnostic aids as the gonadotropin assays for chorioepithelioma and the serum acid phosphate estimation in prostatic carcinoma. Robert Turell, M.D.

**Massive Hydronephrosis.** Howard A. Hoffman. *J. Urol.*, Balt., 1948, 59: 784.

The author presents reports of the cases of massive hydronephrosis seen in the Massachusetts General Hospital, Boston, from 1941 to 1946, inclusive. Because of the relative asymptomaticity of the disorder, the frequent failure to consider it in the differential diagnosis of abdominal masses, the ever-present danger of rupture and shock, the frequent ill-advised performance of laparotomy, and the high incidence of mortality, it was felt that a review of the entire subject was indicated. A review of the literature revealed that the total number of reported cases by the beginning of 1947 was 89, and, of these, a very substantial percentage were misdiagnosed. It is the author's impression that these cases are not as rare as the reports in the literature would seem to indicate; during the period studied 10 cases of massive hydronephrosis were found, an incidence of approximately 3 per cent of all hydronephroses admitted to that hospital in that 6 year period. From this study it was found that the incidence extended through all age groups. Most patients, however, were in the second, third, and fourth decades.

Four of the patients complained of ache in the flank or loin. Of the remaining 6, 2 came in with gastrointestinal symptoms thinking they had peptic ulcer, 2 came in without any symptoms to have a routine check-up for hypertension, 1 appeared with leg and groin pain from thrombophlebitis, and the last was concerned because her clothing kept feeling tight despite repeated letting-out.

On physical examination one-half the patients had a palpable mass in the flank, and that without tenderness. Of the remaining 5, 2 had costovertebral angle tenderness but no mass, and 3 gave an entirely negative physical urological examination.

Six of the 10 patients had essentially negative urine. Of the remaining 4, 2 had pyuria alone, and the other 2 had both hematuria and pyuria. Three of the infections were associated with the Bacillus coli, and one with the Bacillus pyocyaneus.

Except in 1 patient with ureteral calculus, the intravenous pyelogram in no instance gave the diagnosis of massive hydronephrosis. In 6 cases it disclosed only a nonfunctioning kidney. The retrograde pyelogram, however, led to the urologic diagnosis of massive hydronephrosis in 9 of the 10 cases. In this series 9 of the 10 cases had involvement of the left side. There is no definite reason for this, and other authors have claimed that the involvement occurred with equal frequency on both sides. Without urologic study the true diagnosis was not made in any instance. The reasons for definitive surgery were not included in this report; however, in each instance it was the considered judgment of the surgeon that plastic measures were not feasible and nephrectomy had to be carried out. In 1 case permanent nephrostomy had to be done as the kidney was a congenitally solitary one.

The massive hydronephrosis was associated with distinct obstruction of the ureteropelvic junction by aberrant vessels in 2 of the 10 cases. In 3 cases organic stricture of the ureter or junction without aberrant vessels was demonstrated. The kidney destruction was associated with ureteral calculus in 1 case. In 4 cases no obstruction was demonstrable.

It is agreed by most authors that the large majority of massive hydronephroses are congenital in origin. They can attain a large size and remain asymptomatic only when infection is absent. Uncomplicated hydronephrosis then is notoriously unattended by specific symptoms. Thus, the patient does not present himself to the urologist and many cases will not be seen until the sac has ruptured after some abdominal injury. When this occurs the diagnosis is quite likely to be missed and laparotomy is carried out because an intra-abdominal accident is suspected as the cause of shock.

Pyelographically, the condition suggests itself by a displacement of the ureter medial and to the opposite side (as in tumor). If a ureteral catheter can be passed by the obstruction, the diagnosis can readily be made. Plastic repair should be considered in each case, but it is not reasonable that such can often be carried out. The cortex has usually been irreparably damaged and nephrectomy must be performed. When the hydronephrosis is infected and the patient is septic, a 2-stage procedure may be lifesaving. Robert O. Beadles, M.D.

**Recurrent Renal Calculi.** James C. Kimbrough and John N. Frust. *J. Am. M. Ass.*, 1948, 137: 219.

The authors discussed the management of recurrent renal calculi complicating the recumbency of patients with war wounds. Only cases in which the patients were treated by operative procedures are

reported in this article. The literature on the incidence and causation of renal calculi is reviewed in some detail. The authors believe that recumbency with its attendant urinary stasis is a major causative factor of renal calculi in many militarized patients. Patients with paraplegia and with complicating vesiconeurogenic conditions constitute a special problem. Almost all of these patients have urological infections. It is believed that recumbency, stasis, and infection cause a high incidence of renal calculi. Also, damage to renal tissue by infection, battle injury, or surgical procedures has played an important part in the recurrence of calculi.

Because calculi act as foreign bodies causing renal damage, they should be removed by open surgery without undue procrastination; a policy of watchful observation may be dangerous. Of the 25 patients treated by operation, 12 had one previous operation and 13 had two or more previous operations. The calculi were removed from 8 patients (32 per cent) by pyelolithotomy, from 3 (12 per cent) by nephrolithotomy, from 7 (28 per cent) by nephropyelolithotomy, from 4 (16 per cent) by calyceal resection, and from 3 (12 per cent) by nephrectomy. Pyelolithotomy is the operation of choice, but it is rarely possible as a secondary operation. On account of previous renal surgery, the kidneys in these patients are adherent to the adjacent structures which makes exposure difficult. The subcapsular approach reduces to a minimum the damage to the kidney and adjacent organs and therefore is the preferred operative procedure.

The authors believe that the removal of renal calculi is only one phase in the management of renal calculi and may be a misdirected effort unless there is appropriate postoperative care and thought to prevent recurrence of the calculi. The regimen for the prevention of recurrence is summarized. Roentgenologic follow-up should be carried out at 3-month intervals in order to detect early recurrence.

ROBERT TURELL, M.D.

Fig. 1. (Garcia and Rocchi) Shows the megaureter with strictures.

**Megaureter. Pyeloureteral Anastomosis with a Loop for Exclusion** (Megaureter. Anastomosis pieloureteral con asa excluida). A. E. GARCIA and A. ROCCHI. *Rev. argent. urol.*, 1947, 16: 153.

A woman, aged 38, was admitted to the hospital with complaints of frequent pains in the right lumbar region of 2½ years' duration. The attacks of pain were accompanied by fever and vomiting.

The right flank was painful to palpation. The urine had an acid reaction and its sediment contained

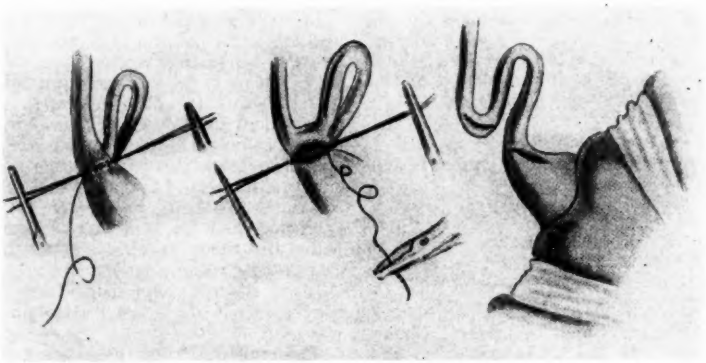

**Fig. 2. The anastomosis between the renal pelvis and the ureter.**

epithelial cells and the usual amount of white and red blood corpuscles and micro-organisms. Retrograde ureteropyelography demonstrated a greatly dilated right ureter with angulations. The findings were less pronounced on the left side.

Under peridural anesthesia Eckehorn's incision was made, which exposed the right kidney and the corresponding ureter in its entire length. Angulations were relieved by an extensive ureteropyelolysis but the strictures remained. A longitudinal incision was made through the renal pelvis and another through the upper portion of the ureter and both incisions were united with one layer of plain catgut number 00.

The patient made an uneventful recovery. Excretory urography and retrograde ureteropyelography in anteroposterior and oblique directions demonstrated a well functioning anastomosis.

JOSEPH K. NARAT, M.D.

**Two Cases of Tumors of the Ureters. Discussion of the Surgical Treatment** (Dos casos de tumores del ureter. Consideraciones sobre la terapeutica quirurgica). ALBERTO E. GARCIA AND JOSE CASAL. *Rev. argent. urol.*, 1947, 16: 193.

The majority of tumors of the ureter are located at the lower end. Two such cases are reported by the author. The first patient, a man 64 years of age, was admitted with complaints of hematuria of 4 months' duration. A papillary proliferation was found at the cystoscopic examination in the region of the left ureteral orifice. No dye was excreted by the left kidney during the first 15 minutes after its injection. An excretory urogram showed a left pyeloureteral ectasia. A total left nephroureterectomy with partial excision of the bladder was performed. The histologic diagnosis was paramalpighian epithelial blastoma.

The second patient, 50 years of age, came with complaints of hematuria of 4 years' duration. The cystoscopic examination revealed a tumor at the orifice of the right ureter. Excretory urograms demonstrated a dilatation of the lower portion of this ureter. The transvesical approach was used to remove the tumor. The histologic examination revealed numerous atypical cells and many mitoses. The conservative procedure in this case was justified because the dilatation of the lower portion of the ureter was moderate while the upper portion appeared normal.

For the purpose of ureteronephrectomy the author advocates a double incision, one in the lumbar region and the other in the lower midline.

JOSEPH K. NARAT, M.D.

**Urinary Calculi.** HAMILTON W. MCKAY, H. HAYNES BAIRD, AND KENNETH LYNCH, JR. *J. Am. M. Ass.*, 1948, 137: 225.

The authors analyzed 200 cases of urinary calculi and discussed the management of ureteral stones. Of the 200 patients, 77 had renal stones, 20 had stones in the upper part of the ureter, 11 in the middle of the ureter, 90 in the lower part of the ureter, and 10 in the bladder; there were 4 patients with bilateral ureteral calculi and 12 with bilateral renal calculi. The mortality rate was 0.5 per cent. Chemically, the stones were composed of the following: (1) calcium carbonate, (2) calcium phosphate, (3) urates, (4) mixtures of calcium carbonate, calcium phosphate, and urates, and (5) oxalate (rare).

The greatest difficulties were encountered with small rough stones in the terminal aspect of the ureter. Because of the well known difficulties, the authors devised a new ureteral open surgical technique which is described in detail. The transvesical or intravesical approach to impacted stones in the intramural part of the ureter or just back of the bladder is believed to be of value at times. The technical steps of this procedure are also briefly outlined.

In the discussion, GOLDSTEIN stated that the authors had wisely and rightfully held to no conventional procedures. He believes that the surgical policies described in the article are now in practice in most of the larger clinics. Goldstein has in the past few years gradually increased the percentage of open operative procedures for the elimination of ureteral stones.

LIVERMORE, the inventor of one of the metal instruments for the removal of ureteral stones, condemned them because they are dangerous and may damage or puncture the ureter; he believes that only ureteral catheters and flexible bougies should be used.

As to the best time to operate, this depends on the condition of the patient and the judgment of the urologist.

ROBERT TURELL, M.D.

## BLADDER, URETHRA, AND PENIS

**Total Cystectomy for Carcinoma of the Bladder** (La cistectomia total en el cancer de vejiga). RICARDO ERCOLE. *Rev. argent. urol.*, 1947, 16: 291.

Poor results of a partial cystectomy for the treatment of infiltrating carcinoma of the bladder induced the author to employ a total prostatocystectomy. The operation is not performed if metastatic adenopathies are present.

In 10 of 11 patients the ureters were implanted into the intestines and in 1 into the skin. In 9 patients a one-stage operation was employed for the implantation of the ureters into the intestines, while in 1 patient a two-stage operation was performed. One patient succumbed to the operation. In 8 patients a complete cystectomy was done without postoperative mortality. Two patients expired 1 year and 1 patient, 1½ years after the operation. Of the remaining 5 patients, 3 were alive 1½ years after the operation, in 1 the bladder was extirpated 20 days before this report was made and in the other it was extirpated 3 months before.

In 7 of the 8 patients, the abdominal approach was used and in 1 a combined abdominoperineal route was used.

The implantation of the ureters in the skin as a preliminary step to the extirpation of the bladder is

advocated by the author only if a dilatation of the ureter is present. Otherwise an implantation into the intestines is preferable. JOSEPH K. NARAT, M.D.

**Myxosarcoma of Urinary Bladder in a 2-Year-Old Child** (Mixosarcoma de vejiga en un nino de 2 anos). R. DE SURRA CANARD AND J. E. RIVAROLA. *Rev. argent. urol.*, 1947, 16: 259.

A child 2 years of age had developed incontinence of the urine for 5 months. Loss of appetite, rise of temperature, and pain in the suprapubic region occurred 3 days before entry into the hospital.

The physical examination revealed a globular tumor in the suprapubic region.

The tentative diagnosis of retrovesical cystic tumor was changed after cystoscopic examination to that of diverticulum of the bladder, due to a persistent, dilated urachus. Cystographic examinations showed an abnormally large shadow in the suprapubic region suggestive of multiple cysts. Operation was performed under ether anesthesia. Numerous nodules were found on the anterior and lateral aspects of the bladder in the region of the trigonum and infundibulum. The invaded portion of the bladder was extirpated and a suprapubic drain was inserted.

The histologic examination established the diagnosis of a vegetating papillomatous myxosarcoma.

One week later a digital enucleation of the remaining tumors was undertaken and this procedure was followed by x-ray therapy. Seven weeks after the first operation the endoscopic examination disclosed several nodules. Four and one-half months after the first intervention a plastic operation was performed for ectropion of the mucosa. A tumor of the size of a tangerine appeared in the operative region 6 months after the first operation. The child succumbed to cardiac failure during the attempt to perform a total cystectomy and an implantation of the ureters into the sigmoid.

The great majority of tumors of the urinary bladder in children belong to the group originating from the mesenchyma. In order of frequency, myxomatous tumors occupy the second place after sarcoma. Clinically, they show malignant characteristics, although histologically they appear to be benign.

After extirpation such tumors usually recur rapidly. Metastases are rare. The tumors do not respond to x-ray or radium therapy. The general condition begins to suffer in the early stages of the disease because of the neoplasm itself and the resulting mechanical obstruction.

The treatment consists of total cystectomy.

JOSEPH K. NARAT, M.D.

## GENITAL ORGANS

**Retrovesicoprostatic Cysts; Hydatid Cysts of the Pelvis** (Les kystes rétro-vesico-prostatiques; kystes hydatiques du bassin). L. SABADINI. *Lyon chir.*, 1948, 43: 179.

Hydatid retrovesicoprostatic cysts are not as common as echinococcic cysts in other locations. They constitute a secondary, rare type of these cysts. As Deve has shown, the intraperitoneal rupture of an abdominal cyst (hydatid cysts of the liver or spleen) may give clinical, abdominal, vesical, and pseudoprostatic symptoms that are difficult to interpret, for one does not suspect this localization of the echinococcal disease.

The author was able to find a limited number of cases in the literature. Deve-Gendy found 106, or 3.8 per cent of 2,727 cases of hydatid cysts, to be of the pelvic type. The author knew of 29 cases. Sixteen were collected by his pupil, Pierre Bernard, and 6 by Surraco. There were 7 cases in his experience, 3 nonpersonal and 4 personal cases.

The first patient was hospitalized because of acute urinary retention. He had frequency of urination and nocturia from ten to fifteen times a night. The urine was clear; there was never any hematuria. He later had constipation with pain on defecation. A diagnosis of retrovesicoprostatic hydatid cyst was made. At surgical operation, a cyst containing 500 c.c. of fluid was evacuated. This fluid was replaced with formalin for a few minutes. Curettement was followed by the evacuation of numerous daughter cysts and with complete extraction of the mother membrane. The orifice of the cyst was marsupialized. The wound was drained. The incision closed 30 days following operation without complication.

The second case was that of a 14-year-old Algerian who was hospitalized because of a tumor in the right iliac fossa and urinary symptoms. On examination, the abdomen was distended and the author had the impression that there were multiple tumors present. On physical examination, x-ray studies of the urinary tract and barium enemas suggested a diagnosis of peritoneal echinococcic disease. The surgical exploration revealed a large iliopelvic subperitoneal cyst along with many intra-abdominal cysts. The cysts were evacuated and lavaged with formalin solution, the cyst cavity was curetted, and the mother membrane was removed. The incision was closed with marsupialization of the edges of the cyst cavity. The patient developed an omental cyst 10 months after this operation.

The third case was that of a 35 year old man who was hospitalized because of a large tumor extending between the umbilicus and the pubis. The patient developed intestinal pain with diarrhea. He also had polyuria and nocturia 7 or 8 times a night. Physical examination, rectal palpation, x-ray findings, and the Casoni test suggested the possibility of hydatid cystic disease. The diagnosis was in doubt, however, but the possibility of a retrovesical hydatid cyst extending into the sacral region was considered. A surgical intervention with an exploratory operation was done. The cyst was exposed by a suprapubic incision made under local anesthesia. The cyst was evacuated and injected with formalin solution. Curettement was followed by the removal of the mother membrane. The incision was closed with marsupialization of the sac. The incision closed in 40 days following surgery.

The fourth case was that of a woman 32 years of age who entered the hospital with an admission diagnosis of torsion of an ovarian cyst. After examination, surgical intervention was advised. At operation, a retrovesical cyst was found between the layers of the broad ligament. A second one was found in the posterior layer of the broad ligament. On extension of the incision a large cyst was found on the inferior aspect of the liver.

The pelvic localization of the echinococcal cyst is never primary. It is always secondary, as Deve has shown. It follows the rupture of intra-abdominal hepatic or splenic cysts. The site of the cyst may take two positions; it may be retrovesical or retrovesical and prostatic.

The superior vesical cyst compresses the bladder and causes diminished capacity with polyuria. The inferior vesical cyst causes pain on micturition and dysuria. The hydatid cysts have the same development as echinococcal cysts in other locations.

The symptoms of retrovesical cysts are polyuria and dysuria. The patient has frequent diurnal and nocturnal micturitions. The urine is rarely purulent unless a renal infection is also present.

The physical signs are certainly characteristic. The suprapubic abdominal pelvic tumor gives the impression of a distended bladder. If the cyst is vesicoprostatic, rectal examination permits the palpation of a rounded mass above the prostate. It is not possible to reach the upper limits of the mass. On rectal examination associated with hypogastric palpation, one is able to obtain some impression as to the size of the mass.

Urethrocystoscopic examination, cystograms, and barium enemas were used by the author to establish diagnostic criteria. The posssibility of distention of the kidney pelvis and the ureter should make a renal examination advisable.

The diagnosis of hydatid retrovesical prostatic cyst is easy when it is associated with a hydatid disease background. The retroprostatic mass might suggest a prostatic abscess, but its indolence, resistance that is nonfluctuant, the absence of draining pus at the urinary meatus, the ease of transversing the urethra, the absence of temperature, leucocytosis, and polymorpholeucocytosis nullifies this diagnosis. If the cyst is large, a hypogastric mass produces concluding evidence of the disease. Simple catheterization will establish that the tumor is intraperitoneal rather than due to a distended bladder. Rectal examination shows a hypogastric mass, but an intra-abdominal tumor is difficult to diagnose by rectal palpation.

X-ray examination after a barium enema helps to confirm the presence of an intra-abdominal lesion.

The Casoni test is positive for hydatid cysts and helps to establish a diagnosis.

The treatment is surgical with early intervention to prevent complications of infection, rupture, and definitive renal lesions due to compression of the ureters. The therapeutic measures are the same as they are in the other locations of echinococcal cysts. It is a question as to whether one should evacuate the cyst with immediate closure or with marsupialization of the opening. The author favors marsupialization, even though the convalescence is longer, as the results are better.

A suprapubic incision is made with the patient in the Trendelenburg position. The peritoneal cavity is retracted. If intra-abdominal cysts are found, they are enucleated and the peritoneum is closed. The vesical region is then exposed and two masses are seen, the superior one, the cyst, and the inferior one, the bladder pressed against the pubis. The superior surface of the cyst is cleared and the surrounding structures are protected by formalin compresses. The cyst is punctured and the contents are evacuated. The fluid is replaced with formalin solution which is retained for 10 minutes. The cavity is curetted and all the daughter cysts and the mother membrane are removed (if possible, in one piece). The pouch is marsupialized with closure of the incision about a drain. The large retrovesical cysts are more often closed without drainage and marsupialization.

In résumé, the author presented 4 cases of retrovesical hydatid cysts. The existence of intraperitoneal hydatid disease in 2 of the cases seemed to confirm Deve's opinion that these cysts have an intraperitoneal origin. The physical examination and x-ray findings were presented in these cases. Sabadini advised exposure of the cyst with evacuation of its contents, lavage with formalin solution, curettement, removal of the mother membrane, and marsupialization of the edges of the sac in hydatid cysts of the pelvis. CONRAD A. KUEHN, M.D.

**Hemolysis during Transurethral Prostatic Resection.** C. D. CREEVY. *J. Urol., Balt.*, 1948, 59: 1217.

The author points out that every urologist who strives to resect the prostate gland transurethrally down to the surgical capsule knows that the operation is sometimes followed by uremia and other disturbances.

As a characteristic reaction, the patient has rigor and cyanosis during or shortly after operation; nausea and vomiting often ensue; and oliguria and azotemia may soon appear.

A mild, nonobstructive jaundice and an anemia more severe than would be expected from the loss of blood are typical reactions. Hypertension may occur later.

Since the type of uremia the author discusses seems to occur most often when considerable blood has been lost during or after operation, the azotemia might be attributed to the spasm of the renal vessels. While this condition explains some of the features of the obscure uremia which may follow transurethral resection, it does not account for the mild, nonobstructive jaundice which usually accompanies it, nor does it account for the fact that an anemia out of all proportion to the amount of blood lost by hemorrhage is often demonstrable as early as 24 hours after operation.

Emmett suggested that this phenomenon was due to the sterile water used as an irrigating fluid during transurethral prostatic resection. The sterile water may enter the prostatic veins, producing hemolysis and damaging the kidneys, as these organs are involved when transfusion with incompatible blood is done.

Wardill concluded that the anemia following prostatic operation was identical with that following the crush syndrome or the transfusion of incompatible blood.

Brisk hemorrhage requires the use of large quantities of irrigating fluid at high pressures to permit the operator to see more clearly. When the operation is prolonged, conditions are then favorable to hemolysis. Inability to predict if a hemolytic reaction will occur may be due to the variations in the size and number of the openings made in the prostatic or periprostatic veins and the variations in the size of the veins.

The author reported the case of a man who was operated upon May 28 and expired June 9 of hemolysis following a transurethral prostatic resection. The autopsy findings showed postoperative hemoglobinemia, obstruction of the renal tubules by pigmented casts and toxic changes in the tubules, uremia, hypertrophy and dilatation of the heart from hypertension, pulmonary edema, right hydrothorax, chronic passive congestion of the liver, cholelithiasis, and ascites (from peritoneal lavage). The microscopic sections of the kidney were identical with those from another patient who had anuria following the transfusion of incompatible blood.

The author reviews the literature on renal insufficiency following transfusion of incompatible blood. Similar changes have been found in the kidneys after traumatic muscular ischemia, heat stroke, sulfonamide intoxication, and poisoning with certain vegetable and chemical agents. Lucke has suggested the term "lower nephron nephrosis" for renal lesions of this nature. The changes in the kidneys in these conditions include vacuolation, necrosis, and desquamation of the epithelium of Henle's loops and the distal convoluted tubules. Pigmented casts are found in Henle's loops, in the convoluted tubules and in the collecting tubules. Hemosiderin granules are seen in the convoluted tubules. Edema and cellular reaction are found around the more severely damaged tubules. Precipitated protein may be found in the glomerular capsules which are not dilated, although the tubules proximal to the casts may have dilated lumina and thinned epithelium.

It appears from experimental work that alkalinization is probably harmful rather than helpful in hemolytic reactions, since death usually follows renal failure.

It would seem that the deleterious effects of transfusions with incompatible blood are due to the transport to the kidneys of hemoglobin or one of its breakdown products which damages the renal tubules either by some direct toxic action, by the production of vascular spasm, by plugging of the nephron, or perhaps by all three of these factors. It has been further suggested that the oliguria that accompanies these lesions is due to unselective absorption of the glomerular filtrate by the injured tubules. If hemoglobinemia alone is to damage the previously normal kidney, it must be of a severe type.

Sterile tap or distilled water is usually used as an irrigating fluid in transurethral prostatic resection. If the operation is reasonably complete, many good sized veins in the operative area are opened. The resulting hemorrhage necessitates running the water usually under considerable pressure to keep the field clear, so that the operator may be able to see the bleeding points and secure them by hemostasis. The irrigating water now containing blood already hemolyzed in the bladder may enter the venous system and thereby produce hemolysis.

Investigative work has shown that the plasma hemoglobin averages 3.08 mgm. per cent before, and 45.4 per cent after, the operation. In 3 of 8 patients who developed mild oliguria, elevation of the urea nitrogen and disproportionate anemia in addition to mild jaundice was seen. The postoperative plasma hemoglobin averaged 81 mgm. per cent. This would further support the view that hemolysis occurs during transurethral resection.

The treatment of the patient with severely damaged kidneys as a result of hemoglobinuria is concerned mostly with keeping him alive until natural healing processes within the kidneys can take place. Oxygen therapy seems indicated in the initial stage, for vasospasm probably damages the tubules by reducing the oxygen supply.

The most accurate method of following the fluid balance in the oliguric patient is by accurately ascertaining his daily weight and giving no more fluid than is required to keep that weight constant, or allow it to fall slowly.

The acidosis which usually accompanies uremia must be controlled by the administration of alkalies without overloading the patient with sodium or producing an alkalosis which may further impair the renal function. The anorexia may require tube feeding and the administration of parenteral vitamins. In the early stages nasal suction may control nausea and vomiting. Parenteral replacement of proteins may be required and the anemia resulting from blood loss and hemolysis may demand transfusion. Peritoneal lavage may relieve the body nitrogenous waste until the kidneys resume effective function.

The solution to the problem of hemolysis following transurethral prostatic resection lies in its prevention rather than the treatment of the ensuing hemoglobinuria. The use of irrigating fluid under the lowest possible pressure that will allow the operator to see clearly is important. In order to prevent hemolysis, an irrigating solution that does not hemolyze blood should be used. Saline solution or other inorganic salt solutions cannot be used because, being good conductors of electricity, they diffuse the current from the electrode, which prevents satisfactory cutting and coagulation.

The author used 4 per cent glucose solution as an irrigating medium without hemolytic reaction. He warns that care should be taken when this solution is used in diabetic patients.

In summarizing, the author states that intravesical and intravascular hemolysis may be produced during transurethral prostatic resection by the water that is used as an irrigating fluid. Hemoglobinemia probably does not harm the kidney unless the hemolysis is very severe or the kidney is simultaneously damaged by vasospasm from excessive blood loss or surgical shock, or by the transportation of bacteria from prostate to kidney by the irrigating fluid.

A hemolytic reaction may be recognized at once by measuring the free hemoglobin at the end of the operation. The reaction itself is characterized by chills, nausea, oliguria, a rising urea, mild jaundice, and by an anemia out of proportion to the amount of blood actually lost during or after the operation. The treatment consists in keeping the patient alive until sufficient time has elapsed to permit recovery of the damaged renal epithelium. The hemolytic reaction can be prevented by using an isotonic solution of a poor electrolyte, such as 4 per cent glucose solution, as an irrigating medium during transurethral prostatic resection. CONRAD A. KUEHN, M.D.

**Glycine as an Irrigating Solution in Transurethral Resection.** REED M. NESBIT and STANLEY I. GLICKMAN. *J. Urol., Balt.*, 1948, 59: 1212.

Creevy believes that the anemia, marked oliguria or anuria, loss of appetite, progressive nitrogen retention, and jaundice following transurethral prostatic resection is due to intravascular hemolysis. McLaughlin suggests that the syndrome is produced by the water used as an irrigating medium, which passes into the prostatic plexus of the veins during transurethral resection. Creevy noticed spurts of red urine coming from the ureteral orifices during prostatic resection, and he subsequently found a high level of hemoglobin in the plasma of the patient following operation.

In order to facilitate vision when the resectionist has incised into the periprostatic plexus of the veins, the level of the water reservoir may have to be raised inordinately high, to force fluid into the venous system. Varying amounts of hemolysis might result from this course of events.

Nesbit and Glickman did not observe oliguria following transurethral prostatic resection at the University of Michigan Hospital, Ann Arbor, during the past 16 years. However, the possibility did exist that some of the postoperative morbidity may have been due to unrecognized minor manifestations of this syndrome. None of the authors' patients manifested clinical signs of intravascular hemolysis when preoperative and postoperative samples of plasma or serum were examined.

Many investigators believe that hemoglobinuria in the presence of an acid urine results in the formation of acid hematin which mechanically blocks the renal tubules. Bing thought that the acidosis accompanying the anuria may affect the respiratory enzymes of the tubular cells and account for the impaired renal function. This would provide the reason for alkalinization when hemoglobinuria exists. Renal vasoconstriction induced by hemoglobinemia may result in ischemia of the tubular cells and account for their diminished function.

In Ross' opinion the fatal renal damage is probably produced by shocking levels of blood pressure and by severe and prolonged reduction of the blood flow through the kidney, the latter being accentuated by hemoglobinemia.

The reduction of alkaline reserve may be associated with methemoglobin in acid glomerular filtrate, which would add to the existing tubular damage.

An isotonic irrigating solution that would eliminate the risks of intravascular hemolysis should have the following properties:

1. It must be either nonelectrolytic, or very weakly ionized, for a highly ionizable substance such as sodium chloride allows dispersion of the high frequency current and thereby inhibits its cutting properties.

2. It must be nontoxic when given locally or when administered intravenously.

3. It must be transparent so as not to interfere with visual acuity during the performance of the operation. It must be understood that any isotonic solution used as an irrigating fluid will merely suspend the red blood corpuscles and result in a slightly opaque medium, rather than the clear medium produced by the use of distilled water in which complete hemolysis occurs.

4. It must be relatively cheap to permit its use in large quantity.

Creevy suggests the use of 4 per cent glucose solution and reported its use in 158 cases. This solution makes the surgeon's gloves sticky, and if the operation is performed on a diabetic, careful observation of the blood sugar is required.

The authors used a 2.1 per cent solution of glycine in 45 cases of transurethral prostatic resection without demonstrable hemolysis. This solution was found to be abundant and cheap and it fulfilled the requirements of an isotonic irrigating solution.

The average fluid volume used in the trial series of cases was 12,000 c.c. of fluid during each operation. Thus, the glycine cost per operation was 75 cents, or if a 1.1 per cent solution was used (as it was in 30 patients plus 200 additional cases reported in a note at the end of the paper) the cost of the solution was only 38 cents.

A 20 per cent stock solution of glycine can be sterilized by autoclave in gallon bottles and the solution can be mixed with water when it is needed in the operating room. This method of handling the solution is much easier than making up large quantities in the dilution used at operation.

In conclusion, the authors advocate the use of from 1.1 to 2.1 per cent of the amino acid glycine as an irrigating solution to eliminate the intravascular hemolysis associated with transurethral prostatic resection.

CONRAD A. KUEHN, M.D.

**Varicocele. Surgical Technique Advocated by the Author** (Varicocele. Tecnica quirurgica que preconizamos) LUIS ARMANDO BAGLIETTO. *Dia medico*, B. Air., 1948, 20: 379.

Operation for varicocele is justified because the venous stasis exerts an unfavorable effect on the parenchyma of the testis. A diminution of the exogenous and endocrine secretions is the result.

Two conditions require operative correction: (1) varicosities of the veins of the spermatic cord, and (2) ptosis of the testis with secondary elongation of the scrotum. Although some workers maintain that only a correction of the varicosities is necessary, the author of this article is of the opinion that an orchidopexy is also required.

The author prefers to operate under spinal anesthesia, although the general or local type may also be employed. A 5 to 6 cm. long incision is made slightly above Poupart's ligament. The superficial epigastric artery and vein are ligated and severed. A 2 to 6 cm. long incision is made through the aponeurosis of the external oblique muscle.

Fibers of the cremaster muscle are separated, care being taken not to injure the spermatic artery. A 2 cm. long segment of the vein is resected. A concomitant hernia should not be overlooked. A small hernia may escape detection before the operation. This technique, as compared with an incision through the scrotum, preserves the lymphatic circulation and the sympathetic innervation, allows the discovery of hernia, avoids complications inherent to manipulations of venous plexuses (such as thrombosis, embolism, hematomas, chronic edema), and permits the re-establishment of a sufficient venous reflex.

The spermatic cord is lifted with a finger placed underneath and an orchidopexy is accomplished by suturing both ends of the severed vein parallel to one another. An eversion of the tunica vaginalis is employed only in the presence of hydrocele. The sutured ends of the spermatic vein are attached with interrupted sutures to the fibers of the cremaster muscle.

JOSEPH K. NARAT, M.D.

## MISCELLANEOUS

**Reiter's Syndrome.** R. J. G. MORRISON and M. THOMPSON. *Lancet*, Lond., 1948, 1: 636.

The triad consisting of arthritis, conjunctivitis, and urethritis, first described by Reiter in 1916, and which now bears his name, was found in 9 cases in the British troops in Western Germany and is reported in detail by the authors. A review of the literature revealed various unusual features of the so-called syndrome of Reiter. Not infrequently one or more components of the triad was absent, yet the reporters believed that the disease encountered was actually a manifestation of Reiter's syndrome. It was noted that urethritis might be absent in some cases while in others there might coexist renal complications such as terminal hematuria, hydronephrosis, and chronic pyelonephritis. Recurrences were not uncommon.

A review of 9 cases by the authors revealed uniformly negative smears for gonococci except in 2 of the cases. An elevated sedimentation rate was noted as well as a leucocytosis and sterile pyuria. There appeared to be no association to dysentery. Although the etiological agent is unknown, the authors believe that the disease is a manifestation of an unknown allergic phenomenon. This conclusion is somewhat substantiated by the clinical symptoms and signs of arthritis, variable rashes, and the increased sedimentation rate. An anemia was noted in one case but was unexplainable. In all cases there was involvement of the knee joints while in only a few of the cases were the small joints of the hands involved. While the condition varied considerably in severity from patient to patient and there was no noticeable response to sulfonamides or penicillin, some benefit was apparently derived from intravenous protein shock induced with T. A. B.

PETER L. SCARDINO, M.D.

**The Venereal Granulomas: A Comparative Study of These Diseases in Florida.** WESLEY W. WILSON. *South. M. J.*, 1948, 41: 412.

The venereal granulomas (granuloma inguinale, lymphogranuloma venereum, and also chancroid), occurring in Florida from 1942 to 1947, were studied by the authors. The diagnostic methods employed included: (1) blood serologic studies to rule out syphilis, (2) dark field examination for Treponema pallidum and other spirochetes, (3) smears for gonococci, Donovan bodies, fusospirochetes, Ducrey bacilli, yeasts, etc., (4) intradermal tests (Frei and Ducrey), and (5) biopsy for Donovan bodies in tissue section, since not infrequently it is difficult to demonstrate these bodies in smears because of marked contamination by other organisms. Although limitations are inherent in the methods, they play an important role in the differential diagnosis.

Chancroid lesions developed in from 2 to 3 days after sexual exposure. Positive smears were found in 50.6 per cent of 147 patients examined. Intradermal tests performed with commercial Ducrey vaccine were found positive in 80.6 per cent of the cases in which the clinical diagnosis was chancroid. Therapy consisted of oral sulfathiazole, 4 gm. daily. The ulcerative, vegetative lesions of granuloma inguinale extended into the inguinal region, the perineum, and about the anus. Lesions about the anus occurred frequently in sexual perverts. The lesions were found to occur both superficially and deep, having been demonstrated in lesions of the abdominal viscera, lymph nodes, and bones of the thorax. The successful demonstration of Donovan bodies adequately substantiates the diagnosis.

Of 51 patients treated, complete healing was obtained in 46 (90.2 per cent) by antimonials and surgical excision. The satisfactory response to streptomycin by two failures in the series prompted the authors to advocate the use of streptomycin in preference to other forms of therapy. Twenty-two of the 24 patients with lymphogranuloma venereum

had early lesions occurring most frequently as primary vesicopapules on the penis without bubo formation. Of the 6 female patients, 4 presented ulceration of the vagina with elephantiasis of the vulva, 42 per cent of the patients showed mild to moderate reaction to the intradermal Frei test, and 16 per cent of the patients had a biologically false positive Kahn test. After establishing the diagnosis, sulfathiazole was found to be the drug of choice.

PETER L. SCARDINO, M.D.

**Cancer Cells in Urine.** CARL J. SCHMIDLAPP and VICTOR F. MARSHALL. *J. Urol.*, Balt., 1948, 59: 599.

The results of a study of 333 patients examined by the Papanicolaou technique are reported after a 6 months' period of follow-up. The cases have been arbitrarily divided into three groups: (1) those with clear evidence of genitourinary cancer at the time of examination of the urine (on the grounds of biopsy or overwhelming clinical evidence); (2) those with a strong suspicion of cancer but in which clinical and biopsy evidence was not conclusive; and (3) those in which there was no suspicion of genitourinary cancer. Dr. Papanicolaou's reports were also reduced to three classes: positive, suspicious, and negative.

In 198 cases there was no evidence of malignant cells in the urine sediment. Of these, 176, or 88.8 per cent, were clinically noncancerous; 8, or 4.1 per cent, were clinically suspicious; and 14, or 7.1 per cent, were clinically cancerous.

Fifty-three cases were suspicious, according to laboratory reports, but evidence in the smear did not warrant a diagnosis of malignant neoplasm. Of these, 24, or 45.3 per cent, were clinically cancerous, 6 were suspicious, and 23 were clinically noncancerous.

Eighty-two cases were reported as having definite malignant cells in the smear. Of these, 71, or 86.5 per cent, were clinically cancerous, 8 were clinically suspicious, and 3 had no evidence of cancer clinically.

The authors caution against the clinical application of this method of diagnosis until a fairly large series has been tested against the usual data, especially biopsy. JOSEPH E. MAURER, M.D.

**Exfoliated Cells of Cancer of the Genitourinary Tract.** RICHARD CHUTE and DAVID W. WILLIAMS. *J. Urol.*, Balt., 1948, 59: 604.

The microscopic examination of slides of urinary sediment in the search for exfoliated tumor cells requires much experience, especially as the criteria are not always definite and absolute. The tumor cells are identified largely on the basis of marked variation in size and shape, dark hyperchromatic staining nuclei, giant nuclei, and absolute or relative increase in the size of the nuclei in ratio to the amount of cytoplasm.

The authors have selected 168 cases in which a definite clinical diagnosis was made; 109 of these patients had no malignant disease. Of these 109, 96 (or 88 per cent) were correctly called negative, while 13 (or 12 per cent) were incorrectly diagnosed as positive. Fifty-nine patients had malignancy of the urinary tract and in 32 of these (55 per cent) the malignant disease was detected by the smear, while it was missed in 27 others (45 per cent).

The cases of malignancy were first diagnosed by smear, having been previously partly unsuspected. After extensive urological search, the tumors were located and confirmed by biopsy. The authors stress the use of fresh specimens of urine and of repeated examinations. JOSEPH E. MAURER, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

**Painful Shoulder: Observations on the Role of the Tendon of the Long Head of the Biceps Brachii in Its Causation.** HAROLD H. HITCHCOCK and CHARLES O. BECHTOL. *J. Bone Surg.*, 1948, 30-A: 263.

Lesions affecting the tendon of the long head of the biceps brachii are among the more frequent causes of pain and disability in the region of the shoulder joint. In order to determine the incidence of supratubercular ridge and variations in the depth of the intertubercular groove, as well as their significance in producing lesions involving the biceps tendon, 100 humeri were examined. The supratubercular ridge was found to be markedly developed in 8 per cent of the humeri, and moderately developed in 59 per cent. Contrary to what is often superficially thought, it is not the tendon which slides in the groove, but the humerus which moves on the fixed tendon during motions at the shoulder.

Dislocation of the tendon, complete or incomplete, may be differentiated from peritendinitis by the test of Abbott and Saunders. After full abduction of the shoulder, the arm, which is held in complete lateral rotation, is slowly brought down to the side in the plane of the scapula. A palpable or even audible, and sometimes painful, click is noted as the biceps tendon, now forced against the lesser tubercle, becomes dislocated from the groove.

With a frozen, painful, shoulder, failure of the condition to clear up quickly with manipulation and physical therapy, together with persistent tenderness over the intertubercular groove, very probably means inflammation and adhesions about the biceps tendon. It should not be forgotten that peritendinitis of the long head may be associated with other lesions about the shoulder, such as rupture of the tendon of the supraspinatus. In consequence, the peritendinitis may be overlooked, with resultant disappointment in the results of therapy. Where recurrent or traumatic dislocation of the biceps is found, surgery is indicated. The authors present 3 cases in which their operative findings were discussed.

Adhesions and peritendinitis of the biceps tendon are usually not seen until the tendon has been exposed by incision of the capsule and transverse humeral ligament; the tendon may then be visualized from its origin as far as its point of disappearance beneath the tendon of the pectoralis major. After exposure of the tendon, abduction of the arm will demonstrate whether the humerus slides freely along the tendon or whether it is bound by adhesions under the tendon of the pectoralis major. If such adhesions are present, the terminal portion of the tendon will buckle with abduction. An S-shaped skin incision over the deltoid-pectoral interval serves to lessen the tendency to hypertrophied scar, which is common when a straight incision is employed. The tendon is roughened, and is sutured beneath this osteoperiosteal flap with heavy silk sutures. The transverse humeral ligament is sewed down over the tendon and the osteoperiosteal flap. The portion of the tendon lying above the transverse humeral ligament is resected. The only residual disability is a slight loss in the power of abduction when the arm is in lateral rotation.

The authors indicate that in those cases of biceps peritendinitis in which the patients do not recover properly after conservative treatment, a much more rapid recovery with less economic loss can be offered by fastening the tendon into the groove. The results in 26 such cases were most satisfactory.

C. FRED GOERINGER, M.D.

**Peritendinous Fibrosis of the Dorsum of the Hand.** ROBERT E. VAN DEMARK, JOHN D. KOUCKY, and FREDERICK J. FISCHER. *J. Bone Surg.*, 1948, 30-A: 284.

In contrast to the usual traumatic tenosynovitis which responds to treatment, a painful, persistent, peculiarly hard swelling, localized over the dorsal metacarpal area and absent in the palm, may follow a blow to the back of the hand.

The authors present the cases of 2 soldiers who suffered from recurrent, disabling, hard swelling on the dorsum of the hand following a severe initial blow. In each case, operative exploration and examination of pathological specimens revealed evidence of old and recent hemorrhage, with fibrous-tissue proliferation and organization in the hemorrhagic area.

Infiltration of the extensor tendon by the fibrous tissue offers an explanation for the clinical finding of local pain and limitation of movement during flexion of the fingers. It is evident that with extremes of motion, further hemorrhage, clotting, fibroblastic organization, and increased fibrosis occur deep to the superficial fascia. This explains the recurrent, localized, and hard character of the swelling.

In such cases it would appear that the treatment of choice is early operative evacuation of the primary hematoma, and ligation of any bleeding vessels followed by a firm compression dressing. Involvement of the extensor tendons during the fibroblastic organization of the adjacent hematoma cannot otherwise be avoided with certainty. In late cases, evacuation of the hematoma should be followed by prolonged immobilization in order to allow maturation of the fibrous tissue and obliteration of the hematoma cavity.

It has become generally recognized that recurrence of swelling is common. The number of permanently cured cases is reported by Bettman as small. Iselin states that the "edema" persists indefinitely; the

incapacity is often 60 to 75 per cent, and the prognosis is very poor. A practical form of treatment is suggested by Watson-Jones, who recommends prolonged immobilization in a dorsal plaster splint. This should be continued for several months after the swelling has subsided. C. FRED GOERINGER, M.D.

## FRACTURES AND DISLOCATIONS

**The Results of Treatment of Congenital Dislocation of the Hip in Infancy.** FREDERIC C. BOST, HELEN HAGEY, EDWIN R. SCHOTTSTAEDT, and LOREN J. LARSEN. *J. Bone Surg.*, 1948, 30-A: 454.

The standards of Severin and Ponseti were used in an evaluation of the anatomical and functional results of treatment in 112 cases of dysplasia and dislocation of the hip. The following methods of treatment were used:

The abduction frame was used in 32 cases; traction on the Coonse modification of a Putti frame, followed by manipulation, was used in 13 cases; manipulation alone was used in 31 cases; remanipulation was used in 8 cases; multiple manipulations (more than three) in 3 cases; open reduction with or without shelf operation was performed in 21 cases; the shelf operation only, in 2 cases; and no treatment was given in 2 cases. The abduction bar proved very effective in infants under the age of 1½ years. No failures were encountered in effecting satisfactory reduction of the dislocated hip.

Excellent, or nearly excellent, anatomical results were obtained in 55.4 per cent, and excellent functional results were obtained in 60.7 per cent of infants. Deterioriation with age was not expected in this group. The best results were obtained with the least traumatic methods, such as the abduction frame, and gentle manipulation preceded by traction. The gentler methods of reduction could be used in the youngest age group.

Treatment in infancy produced good anatomical results in 81.3 per cent of cases, and good functional results in 80.4 per cent. All of the patients in this group were less than 14 years of age when the ratings were made.

The development of the acetabulum progressed slowly, which indicated a probable need for longer periods of fixation after reduction of the hip. Delay in the reduction of dislocations caused increasing maldevelopment of the hip due, in part, to the thickening of the acetabular floor, coincident with an increase in the Y co-ordinate.

Aseptic necrosis was observed in 52 per cent of the hips. It was present in only 12 per cent of hips treated by abduction, but the incidence following traction and manipulation was 54 per cent, and with manipulation alone, 74 per cent.

An acetabular angle of 27½ degrees was selected as the upper limit of the normal acetabular index in infancy. In all but 2 patients treated within the first year of life, the acetabular index dropped to within normal limits within a period of 18 months. In those patients treated during the second and third years, the descent of the acetabular index appeared more gradual than during the first year, and in nearly one-half of the patients never dropped as low as 27½ degrees. Only 6 patients in this group actually reached the acetabular index of the normal undislocated hip. VERNON C. TURNER, M.D.

**Results of Treatment of Irreducible Congenital Dislocation of the Hip by Arthrodesis.** CHARLES J. FRANKEL. *J. Bone Surg.*, 1948, 30-A: 422.

The author studied the cases of irreducible unilateral congenital dislocation of the hip treated at the Shriner's Hospital in St. Louis and at the University of Virginia Hospital and came to the conclusion that, as compared with the results obtained by the shelf operation or by subtrochanteric osteotomy, arthrodesis offered the most consistently good end results from the standpoint of freedom from pain and satisfactory function. He felt that arthrodesis was especially to be recommended when the economic background was such that the patient would need to do heavy work for a living.

Fourteen patients were treated by arthrodesis, but only 8 had adequate follow-up study. The youngest child was 7 years of age, the oldest 15. Seven patients were girls.

In each case an effort was made to reduce the hip by skeletal traction with from 30 to 70 pounds on the affected femur for from 3 to 8 weeks. Countertraction was obtained by extremely high elevation of the foot of the bed. When reduction was not obtained by this method, arthrodesis was done in as good a position as could be obtained. Prior to traction and surgery, shortening averaged 3.2 inches; after arthrodesis, shortening averaged .75 inch. In no case was there failure to fuse.

VERNON C. TURNER, M.D.

**The End-Results of Early Treatment of Congenital Dislocation of the Hip, with an Inquiry into the Factors that Determine the Result.** A. BRUCE GILL. *J. Bone Surg.*, 1948, 30-A: 442.

One hundred and five patients were selected for study. Of these, 53 were treated by bloodless reduction only, without subsequent operation. The "perfect" end-results are to be found only among those cases that are amenable to bloodless reduction. If open operation is necessary for reduction, one can always observe the presence of one or more of those structural deformities that make the development of a perfect hip impossible. Of marked importance and frequency among these are the deformities of the neck of the femur (anteversion and shortening) and a high attachment of the capsule. Persistent aplasia of the acetabular roof is the most easily remedied of the anatomical defects. Aplasia of the femoral head, erroneously called Legg-Perthes disease, can be observed in practically all cases. Gill believes that this defect is not due to trauma at the time of reduction. Inequality of the size of the acetabulum and head, and capsular constrictions also prevent normal development of the hip. In about

6 per cent of the cases, such marked anatomical changes have taken place (absence of proximal femur, etc.) that reduction is impossible.

In none of the 33 cases in which hips were operated on before 4 years of age, because they were irreducible by manipulation, was a perfect end-result recorded. The author does not deny, but on the contrary, strongly affirms, that satisfactory and even perfect functional results may be obtained by operative procedures for the correction of the various deformities of the hip, but even those with perfect function show some degree of anatomical imperfection.

Approximately 35 per cent of dislocated hips may be expected to become perfect or excellent after bloodless reduction if the reduction is accomplished before the age of 3 years. After 3 years, there is a marked decrease in the percentage of successful reductions. However, whether the reduction was done in infancy or in the third year seemed to make no difference in the statistics. The author believes that the end-result depends upon the degree and importance of the anatomical changes about the hip and that these are not necessarily correlated with the age of the patient. However, the normal relationship of the femoral head to the acetabulum may play an important part in the stimulation of the acetabular roof, and other parts, to normal growth. The congenital dysplasia is caused by a retardation or by an interruption or distortion of the normal growth process. From 15 to 20 per cent of hips may be expected to become functionally "satisfactory" for a varying number of years, with the understanding that arthritic changes within the hip, producing symptoms of fatigue, pain, and limp, are prone to occur sooner or later. VERNON C. TURNER, M.D.

**Follow-Up Study of the Early Treatment of Congenital Dislocation of the Hip.** C. H. CREGO, JR., and J. R. SCHWARTZMANN. *J. Bone Surg.*, 1948, 30-A: 428.

This article is an analysis of the results of treatment of primary posterior dislocation and primary upward luxation, or subluxation, which occurred in 78 hips in 52 patients. The minimum follow-up time was 1 year; the maximum, 15 years. In approximately 50 per cent of the total number of hips the follow-up study had been continued for 6 years or more. In 71 of the 78 hips dislocation was complete.

Skeletal or skin traction was used to bring the head of the femur into position opposite the acetabulum in all 71 cases. Although the position was obtained within 2 weeks, traction was maintained for 4 weeks. Following this, and usually with the use of an anesthetic, the head of the femur could be placed easily into the acetabulum by internal rotation and abduction of the thigh. This position was maintained by plaster for 3 months before further treatment was carried out. In no case were the authors unable to bring the head opposite the acetabulum by traction.

Anterior torsion of the femoral neck was found in 71 cases and, since "experience has shown that the torsion does not correct itself," supracondylar rotation osteotomy was done in 67 femurs. In 5 cases it was repeated because of incomplete correction of torsion by the first osteotomy. After 3 months of fixation in plaster following reduction, a threaded wire was passed through the bone just above the osteotomy site; then the knee and leg were rotated externally to neutral position without fear of disturbing the position of the hip. Further fixation in this position was maintained for 2 months to permit healing of the osteotomy.

In 25 cases open reduction was done when stable seating of the femoral head within the acetabulum could not be accomplished by manipulation. Operation was done to clear away the obstructing fold of capsule and the fatty tissue filling the acetabulum. In many instances the capsule and fatty tissue were eroded by pressure of the head so that after 3 months it became well seated without operation.

If fluoroscopic examination revealed that instability of reduction was due to a shallow socket, an acetabular reconstruction was done. This consisted of levering the superior acetabular rim down over the femoral head, and backing up the levered rim with cancellous bone chips from the ilium. This was done as an extra-articular procedure. A total of 40 such operations were performed, 3 being repeat procedures. Eight of 10 hips classified as presenting primary upward luxation required acetabular reconstruction. It is stated that the operation may be done satisfactorily at an early age (initial treatment).

The authors condemn forcible manipulation and prolonged fixation in plaster in the frog position. In none of the cases did aseptic necrosis of the femoral head, comparable to the changes seen in Perthes' disease, develop. The authors were able to classify 26 hips (33 per cent) of the 78 as anatomically and functionally normal, in this study; 22 (28 per cent) were classified as nearly normal, 24 (31 per cent) as satisfactory, and 6 (8 per cent) as presenting failures. VERNON C. TURNER, M.D.

**Fractures of the Lower End of the Humerus in Children.** D. P. MCDONNELL and JOHN C. WILSON. *J. Bone Surg.*, 1948, 30-A: 347.

A series of 176 fractures of the lower end of the humerus in children was reviewed, and 88 of these were followed long enough to draw some general conclusions with regard to treatment and complications. Of this latter group, 55 were in boys and 33 were in girls. The ages of the patients ranged from 1 to 12 years; the average age was 7. There were 53 supracondylar fractures, 33 lateral condylar fractures, 1 medial epicondylar fracture, and 1 epiphyseal separation of the capitellum. A study of the end-results in these fractures resulted in the following general conclusions:

Contrary to prevailing opinion, supracondylar fractures can produce serious growth disturbances if the fracture lines extend into the epiphyseal centers. Cubitus varus and cubitus valgus are not considered serious disabilities if flexion and extension are com-

plete. However, if the deformity is progressive and is caused by disturbances in the growth centers, disabilities and limitation of motion may occur years after the initial injury.

A satisfactory reduction is one in which the alignment in both planes is good. An anterior or posterior displacement of the fragments, in which the articular surfaces are displaced to a corresponding degree, will produce permanent limitations of flexion and extension. Lateral displacement above the epiphyses will produce valgus and varus deformities but a good functional elbow may still result.

Supracondylar fractures in which the fracture line, or part of it, extends into the epiphyses may produce growth disturbances similar to those which result from fractures of the lateral and medial condyles. If the fragment is intra-articular and not attached to overlying bone and soft tissue, it will undergo avascular necrosis. Supracondylar fractures of this type should have an accurate anatomical reduction; and if the fragments are displaced and rotated, an open reduction is probably the best method of obtaining accurate alignment.

A series of lateral condylar fractures, in which there were poor results in 50 per cent of the patients treated by closed reduction, speaks for the ineffectiveness of this method. Early open reduction with minimal trauma to soft tissues will give the best results. Avascular necrosis of the capitellum will occur if the fracture line separates the epiphysis from the overlying bone and soft tissues. Fractures of half of the capitellum occurred in 2 patients with lateral condylar fractures. One had poor apposition by open reduction, and avascular necrosis occurred in 1 year. In the other, the separation was not complete, the position was good, and healing was uneventful.

Avascular necrosis of the trochlea may occur later, despite good reduction of a supracondylar fracture. It can cause stiffness at the joint, because of thinning of the cartilage and distortion of the articular surface of the humerus.

Delayed ulnar palsy may cause progressive growth disturbances, and was present in 2 cases of severe cubitus valgus deformity.

Fracture of the medial epicondyle will not cause a serious disability unless the fragment enters the joint cavity. Nonunion is difficult to avoid in closed reduction.

RUDOLPH S. REICH, M.D.

**Early Operative Treatment of Fractures of the Tarsal Scaphoid (Le traitement opératoire précoce des fractures du scaphoide tarsien).** F. POILLEUX and M. BONVALLET. *Rev. orthop.*, Par., 1948, 34: 58.

These fractures may be classified schematically into the following types: (1) the type of fracture most frequently observed is transverse, horizontal, or slightly oblique downward and outward, separating two fragments of variable size; the upper fragment is generally the largest and is luxated dorsally, while the small lower fragment remains attached to the plantar ligaments; (2) the vertical, sagittal type; (3) multiple fractures with crushing of the bone and flattening in the anteroposterior direction; (4) without displacement.

The therapeutic indications vary with the type of fracture, as illustrated by cases taken from the literature and 2 unpublished cases of the authors'.

The outstanding fact revealed by study of the different cases is the frequency of unfavorable results following orthopedic treatment of these fractures. There are two main causes for poor results. The first of these is a disturbance in the statics of the foot produced by deformity of the scaphoid which normally constitutes the keystone of the internal arch. This deformity is due to lack of reduction of the original displacement by fracture, secondary reproduction of the displacement, or the formation of pseudarthrosis after correct reduction and retention. Particular attention is called to the frequent occurrence of pseudarthrosis, which explains the appearance of secondary deformities at the time walking is resumed, despite roentgen evidence of satisfactory reduction. The second cause of poor results is astragaloscaphoid and cuneoscaphoid arthritis due to changes in the articular surfaces and tearing of the ligaments. It does not always appear with resumption of walking, but several weeks, and sometimes months, later. Therefore, results declared as good after removal of the cast in orthopedic reduction should not be accepted as valid. These factors are important in fractures with luxation and crushing.

In fractures without displacement and in sagittal fractures which have been correctly reduced, immobilization must be maintained for at least 2 months; even then pseudarthrosis or arthritis may develop and require secondary arthrodesis. In old fractures, arthrodesis after scaphoidectomy is indicated. In fractures with dorsal luxation and in crushing fractures, which constitute the most important group, the usual concept of treatment must be modified. The frequency of incoercibility of the fracture and of secondary reproduction of the displacement, the possibility of the occurrence of arthritis or pseudarthrosis despite correct reduction and immobilization, justify consideration of immediate arthrodesis as the treatment of choice. This will save time, suffering, and repeated interventions. The authors favor scaphoidectomy with partial resection of the cuboid and mediotarsal arthrodesis, a prodecure which is not more complex than the English method of ankylosing the astragaloscaphoid and cuneoscaphoid joints by a dorsal tibial graft; it avoids taking the graft, and has the advantage of removing the scaphoid, which is subject to pseudarthrosis, and of solidly blocking the mediotarsal joint.

RICHARD KEMEL, M.D.

**Marrow-Nailing of Recent Fractures, Pseudarthrosis and Bone Plastic.** ANDERS WESTERBORN. *Ann. Surg.*, 1948, 127: 577.

In 1944 the author described his first 28 cases of marrow nailing of fractures, and he now gives a report on 72 additional cases. Up until January 5, 1946

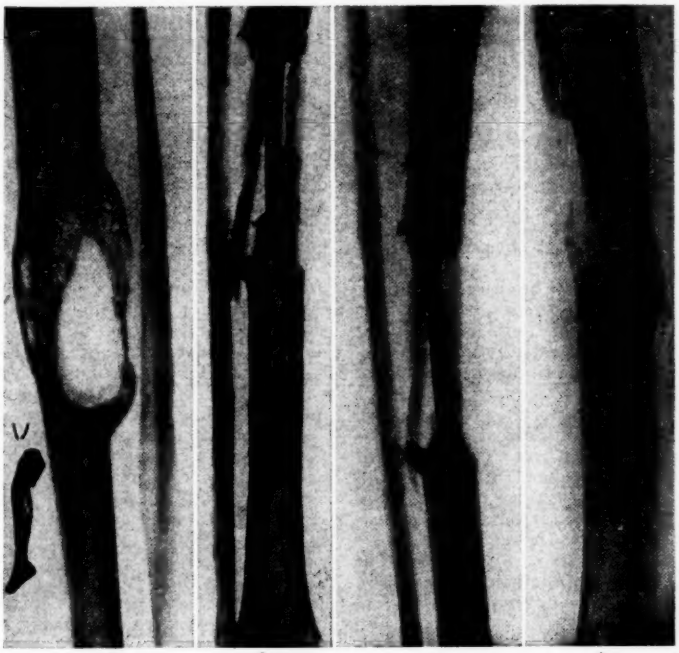


Fig. 1. (Westerborn). a, Cystic giant cell sarcoma of the tibia. b, After resection, bone transplantation and marrow nailing. c, Four months after operation. d, Twenty months after operation.

marrow nailing was used in 100 cases, of which 69 had been recent fractures and 24 pseudarthrosis, and in 7 cases plastic bone surgery was done.

The nail is inserted under fluoroscopic supervision or repeatedly checked by several roentgenograms. The author has made use of the latter method and found it satisfactory. The best results are obtained in the nailing of femoral fractures. The nail must be wide enough so that it establishes firm contact with the wall of the marrow cavity, mainly in order to prevent rotation between the fragments. One can estimate from the size of the marrow cavity in the roentgenogram about what size nail to choose. The conditions are not so favorable in the tibia as they are in the femur, because in the former the cavity is narrowest in the middle. Consequently, it is easy to obtain firm fixation of fractures situated in about the middle of the tibia but not of those situated more distally or proximally. If full stability is not obtained with one nail it is wise to insert another one. This needs to be done more often in cases of bones with uneven medullary cavities, such as the tibia and humerus, than of bones with an even canal.

The advantages of medullary nailing are: (1) a shortened stay in bed, (2) simplified after-treatment —no extension, (3) less pain and other subjective trouble, (4) less risk of stiff joints, muscular atrophy, and circulatory disorder, and (5) shorter hospitalization and earlier acquirement of working capacity.

Marrow nailing involves the danger of bone marrow destruction, fat embolism, and osteomyelitis, but experience has shown that the damage that the nail causes to the bone marrow is of little or no practical significance. It is recommended that the nail be removed when full consolidation is established. After a few months the nail generally lies fairly loosely in the marrow cavity. Extended osteomyelitis, generally, does not develop, but only restricted osteitis, with local sequestration, mainly because of the fact that the pus in the marrow cavity, is led off along the nail. According to Kuentscher, Boehler, and others, there is never any enclosure of pus with rising pressure in the cavity, which pus formation is generally considered to be the cause of extending osteomyelitis. Kuentscher says that whenever there is infection one should drain so that the pus is easily removed, but the nail should not be removed since the fracture generally heals in spite of the infection.

The author has made use of medullary nailing in 24 cases of pseudarthrosis. The bone healing was satisfactory in all except 3 cases in which inflamma-

tion recurred after operation. A report of the results in 18 cases in Kirschner's clinic indicated that bone healing took place in 15 cases within 6 to 8 months after marrow nailing. In order to hasten the bone healing the marrow nailing may be combined with other operations, such as bone transplantation, either in the form of bone clips, according to Levander, or by covering the pseudarthrosis with a larger bone piece. Often, marrow nailing alone is sufficient.

In 6 cases of pseudarthrosis of the thigh bone which persisted from 1.5 to 3 years in spite of attempts with many different methods, it was not possible to obtain osseous healing. In 2 of the cases, persisting fistulas with a slight discharge were present at the time of operation. In one case the fistula healed soon after the operation; in the other there was still slight suppuration at the time the patient was discharged. In order to avoid the risk of reactivation of a latent infection, sulfathiazole was introduced into the operative wound in all of the cases. In 3 of the 6 cases, consolidation had taken place before the patient was discharged. In the other 3 there were indications that osseous healing would take place shortly.

The new method is vastly superior to the old ones for treatment of femoral pseudarthrosis. The postoperative treatment is very simple. After 1 or 2 weeks in bed the patient is allowed to get up. The prolonged stay in bed before the operation produces more or less marked stiffness in the joints as well as muscular atrophy, which necessitates intensive physical therapy. The most important condition for osseous healing is absolutely firm fixation of the fragments.

C. Fred Goeringer, M.D.

## ORTHOPEDICS IN GENERAL

### The Serious Limitations and Erroneous Indications of Biopsy in the Diagnosis of Tumors of Bone

James F. Brailsford. *Proc. R. Soc. M.*, Lond., 1948, 41: 225.

The author engages in an interesting and rather convincing discussion concerning the diagnosis of bone tumors, particularly as to whether they are benign or malignant. Attempts at classification based on the histological appearance are of academic rather than of practical importance as they tend toward erroneous interpretations. Certain simple lesions, which resolve completely when undisturbed, present histological appearances liable to be interpreted as evidence of malignancy; yet this evidence cannot be obtained without biopsy or more extensive surgery. This cannot be done without causing the patient mental and physical pain, or without subjecting the patient to the risks of an anesthetic, complications, and the possibility of erroneous interpretations.

The simple lesions have characteristic roentgenographic appearances which can be verified by serial roentgenography without causing pain or subjecting the patient to any risks. Fortunately, the diagnosis of bone tumors can be checked by clinical observation and serial roentgenography.

Since amputation at the earliest possible moment does not ensure cure of a malignant tumor, and since we have no means of telling whether metastasis has occurred, there is little to be gained by precipitate amputation, but much to be gained by clinical and roentgenographic study.

The author takes issue with the attitude of the orthopedic surgeons who prefer to think that the diagnosis of bone tumors is in the province of the surgeon, who is called upon to explore the tumor in order to obtain tissue for biopsy studies. It is well known that apparently inoperable lesions may resolve completely. Meddlesome interference often obscures the issue, delays resolution, and may prevent complete restitution. Roentgenography, on the other hand, does not inflict pain or risk on the patient. Serial roentgenographic studies of all bone lesions are obtained without causing any pain to the patient. Such studies permit of more accurate diagnosis and better treatment of the patient.

If the roentgenographic appearance can be closely imitated by inflammation deficiency, or other disorders, it would be reasonable to give a course of appropriate medication in any doubtful case, and, if this failed to produce a favorable response, a course of deep x-radiation therapy.

Eleven questions are presented to the reader by the author with appropriate answers. One is convincingly impressed with the more conservative trend and the emphasis which is placed on roentgenology rather than surgery or biopsy studies in the evaluation of bone tumor cases.

Ossifying hematomas, not only in scurvy and osteogenesis imperfecta, but also in limbs with neurovascular disturbances and in hemophilia, and even at the site of unsuspected fractures, have been mistaken on their clinical and histological evidence as sarcomas, and amputation was done when the patients were considered fit enough to stand the operation. Undoubtedly some of these cases have been regarded as "cures by amputation." Although roentgenographs taken of the lungs or skeleton (metastases from osteogenic sarcoma often develop in other parts of the skeleton before they are recognizable in the lungs, the latter being a terminal event) may fail to reveal any evidence of metastases, this is no proof that they do not exist. The author makes it a rule to regard any lesion as simple in the first instance if there is definite evidence of trauma and the roentgenographic evidence is such as could have been produced by trauma. Bone lesions with a history of recent trauma and roentgenographic evidence of changes which could have been produced by trauma should be treated with medicaments, as inflammation, notwithstanding certain roentgenographic features which may arouse the suspicion of malignancy.

Remarkable response of carcinomatous metastases from some primary lesions in the breast or prostate to stilbestrol within a few weeks furnishes hope that some such hormone will be found to cure sarcoma.

C. Fred Goeringer, M.D.

**Bone Changes in the Cat in Experimentally Produced Injury to the Peripheral Nerves.** MAURICE A. SCHILLER. *J. Bone Surg.*, 1948, 30A: 469.

The history of the development of our concept of the causes of post-traumatic bone atrophy is described. This article attempts to throw some light on the argument as to whether the bone atrophy is of organic origin or hysterical.

The author has studied, by means of roentgenograms, the bones of the extremities of cats, on each of which section of the sciatic nerve had been done 4 cm. below the sciatic notch. Roentgenograms were obtained of the animals 30, 60, 90, 150, or 180 days after the operation. Apparently one set of roentgenograms was obtained of each animal.

In 11 of 18 cases in which the nerve had been sectioned, followed by primary suture and a cast to the extremity, ulcers developed, and in 5 of these there was x-ray evidence of bone atrophy. In only 1 of 11 patients in whom no cast was used, but in whom ulcers developed, bone atrophy was found. In 27 patients in whom no cast was used and ulcers did not develop, there was no evidence of any bone change.

The author concludes that atrophy of bone does not result from denervation of an extremity, nor from immobilization of denervated extremities, but that it occurs as a result of ulceration overlying the bone and joint. VERNON C. TURNER, M.D.

**Contractures following Experimentally Produced Peripheral Nerve Lesions.** IRVING C. SHERMAN. *J. Bone Surg.*, 1948, 30A: 474.

The author reports the following methods by which contractures develop following peripheral nerve injuries.

1. There may be adaptive shortening of an active innervated muscle because of the lack of opposition of the paralyzed antagonist. This is called a myostatic contracture.
2. An "active contracture" may develop in muscles when the motor nerve is irritated or compressed.
3. "Neurogenic protective contractures" may follow peripheral neuritis.
4. Sympathetic nervous system disturbance following mild trauma and associated with traumatic vasomotor and thermic changes in the extremity also produce contractures similar to those seen in rheumatoid arthritis.
5. Fascial shrinkage will produce contracture, as exemplified by Dupuytren's contracture of the hand.
6. "Set contractures" gradually develop after from 6 to 8 weeks of immobilization combined with denervation of a muscle, as in poliomyelitis.
7. Contractures may result after splinting an extremity because of hysteria or habit.

The author studied the contractures of the main muscles of the extremities of cats in which denervation was accomplished by sectioning the sciatic nerve 4 cm. below the sciatic notch. Some of the animals were subjected to primary suture of the nerve, others to delayed suture, and some to immobilization of the extremity in casts following denervation. The contractures were measured as to the degree of limitation of motion with and without anesthesia. Finally, the animal was sacrificed, and the tendons were cut to be sure that the limitation of motion was due to muscle shortening rather than capsular or joint changes.

The author found that contractures developed in 100 per cent of the denervated muscles maintained in a shortened position by casts for from 45 to 105 days. On microscopic examination of the muscle, there was found to be excessive fibrous tissue. Contractures developed in 84 per cent of the animals following primary suture, and in 100 per cent following delayed suture after 90 days. The contractures were less severe, less frequent, and less persistent after primary suture than after delayed suture in untreated animals. The longer the difference in time between the recovery of the opposing muscles, the more likely was the development of contracture in the muscle which recovered first.

If electrotherapy was used, there was a delay in the appearance of the contractures, but if it was used for a long period, the frequency and severity approximated those in the untreated animals. Electrotherapy favors the development of contractures in the unparalyzed antagonists of paralyzed muscles. Electrotherapy is therefore favorable in the early treatment of paralysis, but not in the late treatment.

Since the frequency and severity of contractures were greater after delayed than after immediate suture, one is justified in urging early operation after severance of a peripheral nerve.

VERNON C. TURNER, M.D.

**Congenital Absence of the Humeral Head.** A. T. ANDREASEN. *J. Bone Surg.*, 1948, 30B: 333.

The author reports 2 cases of unrecognized congenital absence of the humeral head. Only 6 cases with a similar roentgenographic appearance could be collected from the literature. Experimental data suggests that the time in development at which the fault occurred was probably the joint stage, just when the articular rudiments had separated.

The essential features are complete or incomplete absence of the humeral head with a rudimentary glenoid fossa. The deformity may be unilateral or bilateral. It may be isolated or one of a number of deformities in the same patient. There is relatively slight disability. The humerus is short and abduction movement of the shoulder is limited.

DANIEL H. LEVINTHAL, M.D.

**Function of the Cruciate Ligaments of the Knee Joint.** A. J. HELFET. *Lancet*, Lond., 1948, 1: 665.

The author questions the generally accepted thesis that the cruciate ligaments control the anteroposterior stability of the knee joint. Through anatomical and clinical study he deduces that the cruciate ligaments serve as guide ropes during rotation at the knee joint. Since the medial collateral ligament is fan-shaped, and part of the fan is taut in

every position of the knee joint, the finding of anteroposterior laxity is probably due in part, if not chiefly, to the rupture or weakness of this ligament.

The author's observations indicate that the tibia rotates laterally on the femur in the last 30 to 40 degrees of extension; conversely it rotates medially during the last portion of flexion. The anterior cruciate ligament remains at constant tension during extension and the posterior cruciate acts similarly in flexion.

If the tibia is prevented from lateral rotation during extension, the anterior cruciate ligament is seen to be stretched tightly over the lateral border of the medial femoral condyle. This may be observed at operation for a dislocated meniscus, or rotation may be prevented manually at operative or laboratory examination. This may be the source of medial femoral condyle erosion noted frequently at operation for torn medial meniscus.

In bucket-handle tears of the medial meniscus, the lateral rotation of the tibia on knee extension is prevented. Thus, to gain full extension, the anterior cruciate ligament must be torn at the time of injury, or gradually stretched during convalescence when full extension is acquired. The fact that lateral rotation is prevented during extension in this type of meniscus tear serves as a clinical test in diagnosing knee injuries. Although extension may not be complete in effusion or injuries to the fat pad, lateral rotation takes place.

The author notes that anteroposterior laxity of the knee joint in ligamentous injury is almost always associated with tears of the medial collateral and the anterior cruciate ligaments.

With the hypothesis that much of the sensation of weakness and instability of the knee joint with relaxations of the ligaments comes from loss of control of rotation, the author suggests certain tendon transplantations to insure lateral rotation of the tibia during extension and medial rotation on flexion.

He advises medial transplantation of the patellar tendon insertion to assist lateral rotation of the tibia, and transplantation of the course of the semitendinosis tendon into a groove in the medial femoral condyle to facilitate active medial rotation during flexion.

A report of 7 cases of anteroposterior instability of the knee with satisfactory results is given. The patients have fairly good knee control and stability on walking up and down stairs and on rough ground. At rest, the abnormal movement is present as prior to operation. KENATH H. SPONSEL, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Surgery in Peripheral Vascular Disease.** HARRIS B. SHUMACKER. *Surg. Clin. N. America*, 1948, 28: 294.

In the present communication it is the author's purpose to discuss general principles in the treatment of peripheral vascular disease and the application of some of the commonly used surgical measures. He makes no effort to present the detailed management of patients suffering from these disorders nor to consider all the operative procedures of value. The author hopes that this approach will not convey the impression that he holds lightly the importance of the most minute attention to details in prevention, diagnosis, and treatment of the peripheral vascular disorders.

It must be recognized that certain limitations exist in the prevention and treatment of peripheral vascular diseases and injuries. In the first place, at the present time very little or nothing concerning the precise etiology of most of these disorders is known; therefore prevention is impossible. Another limitation which must be recognized is the fact that, in general, the vascular disorders are associated with irreparable changes. A third limitation in treatment concerns the common delay in seeking medical advice. Many of the chronic vascular disorders have an insidious onset and as a general rule patients fail to appreciate the significance of the initial complaints. These limitations just mentioned pertain to the disease processes and to the individuals who suffer from them. There are also, unfortunately, certain limitations which arise as a direct failing of the medical profession. The first concerns a too widespread lack of understanding of the method of obtaining a vascular history and of performing a vascular examination, and a corresponding lack of diagnostic acumen. In large part this is the result of negligent training in medical schools and in postdoctorate education. An occasional related failing of the medical profession concerns a lack of appreciation of the gravity of the situation imposed by significant reduction in blood supply.

The author discusses some of the common surgical operations which are applicable. Sympathectomy, crushing of sensory nerves, amputation, plastic procedures, and arterial embolectomy are discussed.

In summary, the fundamental principles underlying the treatment of peripheral vascular disorders have been discussed and the basis for certain of the commonly applied operative procedures has been presented. It is believed that surgery has much to offer in the treatment of these harassing difficulties provided that the limitations are recognized, that the procedures are utilized upon reasonable indications, and are both skillfully performed and supplemented by proved nonoperative aids.

HERBERT F. THURSTON, M.D.

**Portacaval Anastomosis—Observations on Technique and Postoperative Care.** ARTHUR H. BLAKEMORE. *Surg. Clin. N. America*, 1948, 28: 279.

The author notes that clinicians familiar with the natural history of Laennec's cirrhosis of the liver are well aware of the role of portal hypertension in that disease. In an analysis of 386 cases of portal cirrhosis of the liver, Ratnoff and Patek noted rupture of esophageal varices as the cause of death in 26 per cent of the cases.

Cirrhosis of the liver secondary to hepatitis is a not uncommon cause of portal hypertension and bleeding from esophageal varices. Banti's syndrome with esophageal varices secondary to portal hypertension invariably leads to death, sooner or later, from hemorrhage. Schistosomiasis of the liver that has developed to the point of causing esophageal varices as the result of portal obstruction almost invariably causes death eventually from hematemesis. Finally, in 2 cases of the present series, repeated hematemesis resulted from portal vein obstruction secondary to pancreatitis. The above conditions are considered the common causes of portal hypertension.

When one considers that portal hypertension is one common factor that is responsible for dire consequences, it is not surprising that the subject has received considerable thought in the past. In fact, ever since Von Eck, in 1877, anastomosed the portal vein to the vena cava in dogs, surgeons have accepted the rationale of portacaval shunt for the amelioration of portal hypertension. Though the rationale of the procedure was early accepted, many years were required to forge those advances in surgery so essential to its clinical success.

A method of establishing portacaval shunts, to be clinically acceptable, must meet two important requirements: (1) a high chance of survival for the patient; (2) a high likelihood of maintained patency of the anastomosis.

The author notes that to date portacaval anastomoses have been accomplished forty times with a postoperative mortality of 12 per cent. Success of the portacaval shunt procedure depends primarily upon the selection of cases for operation, careful attention to technical details, and upon preoperative and postoperative handling.

The most serious handicap in the beginning was inadequate knowledge upon which to base an intelligent evaluation of the relative operative risk in a given case. This was particularly true when dealing with cases of cirrhosis of the liver and accounted for 2 of the postoperative deaths.

The onus of infection must always be kept foremost in mind. The subtlety with which a so-called low grade, green streptococcus can wreck, by thrombosis, an otherwise perfect anastomosis should be a caution to all. In the course of a year following the

introduction of the electrothermic method for the treatment of aneurysms at the Presbyterian Hospital, New York, the following routine was established for the prevention of infection: (1) rigid asepsis on the part of the operating team regarding the wearing of helmets, masks, scrubbing, and otherwise scrupulous individual precautions; (2) skin preparation by a soap and water scrub followed by alcohol, ether, iodine, and alcohol; (3) meticulous covering of the skin edge as follows: make the skin incision, ligate superficial blood vessels with fine silk, cover the skin edge with towels held in place by closely spaced Michel clips reinforced with a towel slip at either end of the wound; discard all used instruments and change the gloves before proceeding with the operation; (4) the prevention of air-borne infection by a bacteriologically controlled system of ultraviolet lights; (5) a pleasant but not essential addition to the foregoing regimen for the operating room is air conditioning.

Before the institution of this outlined regimen for the prevention of infection, a total of 5 patients with wired aneurysm became infected, all of whom succumbed. After the institution of the combined regimen some 300 wiring operations for aneurysm were performed at the Presbyterian Hospital over a 10 year period without a single infection. Recent experience has shown that penicillin, even in large doses, cannot be depended upon to prevent infection in cases of aneurysm undergoing the wiring operation. In 2 cases in which penicillin was given in 100,000 unit doses before wiring, and for 14 days after operation at 3 hour intervals, infection developed in the aneurysm in each case. A Streptococcus viridans organism was recovered from both. The only other variation of routine in these operations was the omission of ultraviolet radiation. The above citation is made not to discourage the use of penicillin, but to illustrate that there are bacteria resistant to its action, and the failure to use ultraviolet radiation in these 2 cases has the appearance of a serious omission which shall not be repeated in the future.

In regard to the suture versus nonsuture method, the author notes that there is not yet conclusive proof that the suture method is superior. The score in 3 proved cases is: nonsuture anastomosis closed, 2 cases; suture anastomosis closed, 1 case. All were splenorenal anastomoses. The nonsuture method, however, does have the advantage of conserving the kidney in the splenorenal type of portacaval shunt.

The author discusses factors which stem basically from the hemodynamics of the venous system, which, in general, when compared to the arterial system, are unfavorable for the continued patency of anastomoses. According to the author the following measures should be taken in portacaval anastomosis: (1) the avoidance of twisting of the anastomosed veins, or angulation upon repositioning of the viscera; (2) measures to maintain the blood pressure at satisfactory levels from the time the anastomosis is opened until it is healed; (3) measures to prevent abdominal distention; (4) avoidance of early ambulation; and (5) anticoagulant therapy. The accuracy of blood clotting time determinations is, of course, the first prerequisite to safe heparinization in these cases.

A great deal of unnecessary confusion and blood loss may be eliminated at the time of opening the anastomosis if the surgeon has properly and carefully ligated, with transfixion ligatures, all venous branches in mobilizing the splenic vein before starting the anastomosis. Usually a 4 cm. to 5 cm. segment of splenic vein is adequate. Extreme care must be taken in accurate placement of the first anastomosis sutures to prevent twisting of the splenic vein. Any significant angulation of the splenic vein should disappear upon replacement of the kidney in its normal position posteriorly. In summary, the author has reviewed some of the common causes of portal hypertension. The rationale of the portacaval shunt for the control of gastrointestinal hemorrhage due to portal hypertension is discussed. Factors having a bearing upon the operative risk and success of the portacaval shunt procedure are emphasized. Points in technique are discussed.

HERBERT F. THURSTON, M.D.

**Arterial Anastomosis in War Wounds of the Extremities.** WILLIAM F. MACFEE. *Surg. Clin. N. America*, 1948, 28: 381.

War wounds involving the peripheral arteries are among the most distressing encountered, for they may appear to be limited in extent and yet become disastrous in consequence. The total incidence of arterial injuries in the armed forces of the United States in World War II was 0.96 per cent, and in wounds of the extremities 1.4 per cent. Usually the casualty has multiple wounds, and there is widespread destruction of soft tissue which precludes simple suture repair of the vessel.

Rose, Hess, and Welch demonstrated that the arteries of greatest surgical importance in war wounds are the axillary, brachial, femoral, and popliteal. The principal injuries found in these arteries are spasm, contusion, complete and incomplete lacerations, traumatic aneurysms, and arteriovenous fistula. The definitive treatment of the last two is delayed weeks to months and need not concern the forward hospital.

Sympathetic block with procaine was the procedure most often used for arterial spasm. Results were sometimes good, but not consistently so, and it is probable that the method could not be given a fair trial under combat conditions. Arterial contusion results in thrombosis if the intima is broken, and in late secondary hemorrhage with hematoma formation and its complications if the arterial wall is sufficiently damaged. Embolectomy is less helpful than might be thought, for the procedure is useless without anticoagulants, and these agents are almost impossible to use in the forward area. The immediate danger from incomplete laceration is fatal hemorrhage. It is the wound which, if seen

early, is most favorable for simple suture repair. If seen late, when thrombosis has occurred in the distal arterial tree, a satisfactory outcome may be hopeless. Completely severed arteries can be treated adequately, in most cases, only by some method of bridging the gap, for there is wide retraction of the cut ends, destruction of collateral vessels, and loss of soft tissues with a segment of the major vessel. Blakemore and his associates, using a vein graft with vitallium tubes or cuffs, believed that a basis for success for this type of anastomosis was established for the first time, for infection and thrombosis could be controlled with anticoagulants, sulfonamides, and penicillin. The total reported experience of several authors is thought to be insufficient to warrant a clear appraisal of its worth, yet it seems to be a step in the right direction. Glass and plastic (alkathene) tubes with and without vein grafts were also utilized for this type of injury.

Tables are given of the results, reported by several authors, of these various methods of restoration of the injured vessel. A comparison is also furnished of the end-results obtained by all methods of treatment without regard for the author. These results need not be reported in detail, for the wide discrepancies between the results obtained by different authors make interpretation extremely difficult, and indicate the many variables present in a problem of this nature.

It is obvious that a satisfactory method of restoring the function of an artery severed by a high velocity missile is yet to be developed. The prepared vein graft of Blakemore, the use of anticoagulants, although generally unsatisfactory in the field, and the antibiotic preparations are partial answers to the problem. It may be that the inevitable conditions of warfare may be more responsible for the failures than the methods employed.

ALLAN D. CALLOW, M.D.

**Fourteen Attempts at Arterial Thrombectomy Following the Method of Jean Cid dos Santos. Deobstruent Thromboendarteriectomy.** (Quatorze essais de thrombectomie artérielle suivant la méthode de Jean Cid dos Santos. Thrombo-endartériectomie désobstruante). RENÉ LERICHE. *Mém. Acad. chir.*, Par., 1948, 74: 100.

The author describes his experience in 14 attempts at thrombectomy for arterial thrombosis. With the technique described by dos Santos a line of cleavage is established between the media and inner elastic lamina so that the arterial intima is removed with the thrombus. At times a good part of the media is also removed with the clot. When the arterial lumen has been cleared, the blood flow is restored through a tube in which there is no endothelium. Heparin is administered routinely, but even when the period of heparinization was limited (by hemorrhage) to 45 hours, there was no clotting.

The operation requires exposure of the full length of the thrombosed artery in order that hemostatic forceps may be placed above and below the thrombus as well as on all the patent branches. Originally, following dos Santos, the author and his assistant attempted to ream out the thrombus and the adherent endothelium with a bistoury, starting from either end. They now use the technique of Reboul in which the artery is incised its full length. After the thrombectomy has been completed the artery is reconstructed with a continuous lock stitch of fine silk. Before the clamps are released the artery is filled with serum in order to detect leaks and drive out the air. Heparin is injected into the artery at the end of the operation and heparinization is continued during the postoperative period. In 3 cases severe hemorrhage was attributed to heparin; it was fatal in 1 of them.

In the 14 attempts, 7 operations were completed as planned. One patient died of hemorrhage with a permeable artery. Three patients had excellent results and 2 had recurrence of the thrombosis. (The author does not give the result in the seventh case.

Because of the uncertainty of the operation it is suggested that lumbar sympathectomy should also be performed, but at an earlier time because of the danger of hemorrhage when heparin is used, to safeguard the patency of the thrombectomized artery.

THEODORE B. MASSELL, M.D.

**So-called Syndrome of Arterial Embolism and Acute Ischemia of the Extremities** (Syndrome dit d'embolie artérielle et ischémie aiguë des membres). MARC ISELIN and HEIM DE BALSAC. *Mém. Acad. chir.*, Par., 1948, 74: 227.

The authors show that the classical concepts regarding aseptic embolism of the extremities do not explain all the facts found and published by many surgeons, but a study of 9 personal cases has allowed them to elaborate a totally different theory. These 9 cases presented a nearly identical symptomatology but differed greatly in operative and autopsy findings. This puzzled the authors until they decided to abandon the embolic hypothesis and to accept arrest of the arterial pulsations as the initial primary phenomenon, and the formation of clots as secondary, with the time of its appearance depending on the condition of the patient. This postulate explained everything.

Because a clot was found in the artery in some cases after an ischemic syndrome, the classical concept concluded that the clot arrived there by migration, although this could not be proved in the majority of cases. However, it is more in accord with clinical observation and more fruitful in therapeutic conclusions to separate the known facts from guesses at the mode of appearance. The incontrovertible facts are the following: (1) a characteristic clinical syndrome, consisting of severe pain, stupor of the extremity, signs of gangrene progressing rapidly, and absence of pulsations and oscillations, and (2) variable anatomic or operative findings: the artery may be obstructed or free, its walls altered or intact, and the neighboring veins normal or thrombosed. Therefore, it is appropriate to describe simply an anatomoclinical syndrome of acute ischemia of the extremities of

variable etiology, including arteritis (pseudembolic form of chronic arteritis), spasm, embolism, phlebitis, and even traumatism. Whatever the origin may be, the course to follow is the same.

Medical treatment: emergency administration of heparin and then of dicumarol, the latter under laboratory control. At the same time, treatment of the spasm with papaverine given intravenously and slowly (from 0.06 to 0.20 gm. in the first 2 hours) and by novocain infiltration of the sympathetic. A period of 24 hours seems to be long enough to determine whether the treatment will succeed or fail.

Operative indications: if the patient is in an alarming condition with circulatory failure, operation is useless. If he is in good condition, the lesion being only local, the decision to operate must be based exclusively on the persistence of pain and the signs of clinical ischemia.

Choice of operative method: after exposure of the artery under local anesthesia, the following conditions may be encountered and the intervention will vary accordingly. (a) Venous thrombosis; separation of the artery from the vein and, if the arterial pulsations return, phlebectomy only. (b) Hard and thrombosed artery with periarteritis; arteriectomy to save the collateral route. (c) Small, spasmodic, hard and probably thrombosed artery; arteriotomy to remove the clot; if blood continues to dribble, milking of the artery as high as possible; if this is unsuccessful, introduction of an oiled sound to verify the absence of an obstacle. (d) Doubtful case: Leriche resects the artery when the endothelium seen through the arteriotomy wound is altered, when speed is indicated by the patient's condition, when suture is made difficult by the local conditions, when the thrombosis recurs immediately after suture, and when there is an embolism from an infected endocarditis.

Periarterial sympathectomy should be added if it will not complicate the intervention. It is advisable to inject heparin directly into the artery before closing it. In general, if the pulsations return the prognosis is good; if they do not, the prognosis is poor and all possible measures must be utilized.

Of the 9 patients operated upon, 4 survived and 5 died.

RICHARD KEMEL, M.D.

## BLOOD; TRANSFUSION

**The Influence of Electric Shock and Adrenalin Injections on Leucopoiesis and Erythropoiesis.** HERMAN HORTLING. *Acta med. scand.*, 1947, 129: Supp. 201.

The purpose of this investigation was (1) to find out whether severe irritation of the central nervous system by electric shock influences hematopoiesis, and (2) to study the effect of adrenaline injection on leucopoiesis and erythropoiesis.

There were no consistent effects of electric shock on the blood picture, but the bone marrow revealed a slight increase in the ratio of myeloblasts, premyelocytes, and myelocytes to granulocytic forms.

After adrenalin injection, the increase in mature granulocytes and lymphocytes seemed to originate in the blood-forming organs.

These observations do not prove the existence of a neurovegetative regulation of hematopoiesis, but the author believes that "they give a certain technical support to the assumption that it already occurs" in physiologic conditions.

There is a complete discussion of the literature on this subject with a bibliography of more than 400 references. The monograph should be of considerable interest to investigators in this field.

HOWARD L. ALT, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

**Amyotomic Amputations** (Amputações amiotómicas). F. PAES DE VASCONCELLOS. *Arq. pat.*, 1947, 19: 66.

Because there is no satisfactory technique of amputation for the root of the extremities in serious cases, the author proposes a new method which (1) causes little shock, (2) eliminates all elements which may maintain or favor the progress of the morbid factor, (3) assures good exposure of the infected parts when the amputation stump must remain open, avoids secondary contamination of the noninfected parts and allows easy secondary suture of the wound, (4) assures the functional value of the stump, and (5) facilitates a higher type of amputation by extending the incisions, thus complying with the therapeutic indications found during operation.

To fulfill these requirements, the author obeys the following rules. He does not section the muscular mass: the muscle is completely extirpated or is left entirely in the stump, in accordance with the amyotomic rule. He makes the cutaneous incisions so as to outline two flaps which come together over the sites of the vessels and of the muscles which are more deeply inserted. Thus, prolongation of the incisions allows a higher type of amputation, improves drainage and exposure, and, above all, facilitates the maneuver of detaching the insertion of muscles. On the other hand, the cutaneous flaps form two valves: one contains the muscle which was entirely left behind, is attached to the flap by aponeurotic expansions and will cover the bone stump with its tendinous portion, thus avoiding exposure of the bone stump and insuring easy secondary suture when the amputation stump must remain open; the other valve covers a large and amply exposed space, corresponding to the vessels and the removed muscles, through which infection could spread more easily and dangerously.

The author refers to the general principles of the technique and classifies the cases in which it is indicated. He describes in detail the technique of amputation for the root of the upper extremity which he calls "subdeltoid amyotomic amputation," and for the root of the lower extremity which he calls "infratrochanteric amyotomic amputation." He reports his cases and shows how to perform atypical amputations in accordance with the amyotomic technique.

RICHARD KEMEL, M.D.

## ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

**Ulceroglandular Tularemia Treated with Streptomycin.** RAYMOND E. LESSER and SIDNEY MILLER. *N. England J. M.*, 1948, 238: 554.

The authors report 2 cases of ulceroglandular tularemia in which they noted the efficacy of streptomycin therapy in the chronic phase of the disease. The effectiveness of streptomycin treatment in these cases parallels that which has appeared in the literature to date. The second case was of particular interest since it illustrated the clinical course of a 26 year old paratrooper who was hospitalized some 3 months after the origin of the disease.

During the hospital stay the patient was afebrile. With the establishment of the diagnosis of tularemia, streptomycin therapy consisting of 0.2 gm. every 4 hours for a total of 4.4 gm. over a 4-day period was instituted. During treatment there was beginning regression of the lymphadenopathy and diminution of the weakness. One week later all tenderness of the lymph nodes had subsided, but slight residual adenopathy remained. After discharge, the man was seen periodically as an outpatient. Objective and subjective improvement continued, with complete resolution of the adenopathy and with ability to carry on with military performances. Except for weakness and nausea following exertion, the patient remained well until about 9 months after the streptomycin therapy when he experienced a mild aching sensation in the left thigh, left leg, and left lower quadrant.

Some 11 months after his first hospital admission, the patient was readmitted to the hospital. Because of the rise in the agglutination titer, as well as the significant change in clinical course, it was believed that he was experiencing a relapse. Therefore, streptomycin was started, consisting of 3 gm. daily for 7 days in divided doses, or a total of 21 gm. At the conclusion of therapy the patient felt markedly improved, and the adenopathy slowly regressed. Previously, he had lost 15 pounds in weight. One month after therapy he had regained 7 pounds.

Although the clinical response to streptomycin was definite the subsequent course of the disease indicates probable inadequacy of dosage initially. It may also indicate decreased effectiveness of treatment when a delay occurs between the initial phase of the disease and the institution of therapy. The inability of streptomycin to effect lasting remission in Case 2 was probably due not only to this fact but also to the development of resistance by the organism to the antibiotic agent. The initial amount of streptomycin used may be considered inadequate in the light of current knowledge of organism sensitivity.

C. FRED GOERINGER, M.D.

## ANESTHESIA

**The Use of Prolonged Continuous Spinal Anesthesia to Relieve Vasospasm and Pain in Peripheral Embolism.** SCOTT M. SMITH and VINCENT L. REES. *Anesthesiology*, 1948, 9: 229.

The value of interrupting the sympathetic impulses to peripheral vessels in cases of embolism has

been well established. In the lower extremities it may be accomplished by the administration of spinal anesthesia. This will provide immediate relief of pain and vasospasm and allow one to evaluate the circulation. Procaine is probably the agent of choice and is perhaps best used in a 1 per cent solution.

Prolonged continuous spinal anesthesia has been used in the management of 3 cases of peripheral embolism. In 3 other patients single injection spinal anesthesia was employed for the relief of pain and vasospasm.

No neurologic changes were noted in any of the cases in which prolonged continuous spinal anesthesia was employed. It was noticed, however, that despite the agent used the relative duration and effectiveness of the anesthetic agent became progressively less, and in 2 of the 3 cases two agents were used to prolong the anesthesia to 69 hours and 45 minutes and 43 hours, respectively. A total of 4,450 mgm. of procaine was used in 1 case over a 44 hour period.

Single injection anesthesia and prolonged continuous spinal anesthesia are valuable aids in the treatment of peripheral embolism. In some instances, surgical removal of the embolus may not be necessary when adequate block of the sympathetic nerves to the involved extremity is maintained. Surgical intervention should not be delayed when there is questionable improvement following the sympathetic block. The use of cooling by any method should be avoided. Delay and procrastination have no place in the treatment of peripheral embolism.

MARY FRANCES POE, M.D.

**Combined Anesthesia for Cesarean Section (Low Transverse).** NORA D. DEAN. *Current Res. Anesth.*, 1948, 27: 80.

This author gives a clinical résumé of combinations of anesthetics used in 66 low transverse, cesarean sections at the Memorial Hospital, Louisville, Kentucky, over a 2 year period. The agents used were combined procaine and pontocaine as a spinal anesthetic, with pentothal sodium intravenously. Preoperatively, 1/150 gr. of atropine was given subcutaneously. Fifty milligrams of ephedrine in novocain were injected subcutaneously at the site of the spinal puncture. The solution used was 50 mgm. of procaine crystals dissolved in 5 mgm. of a 2 per cent solution of pontocaine. This solution was mixed with the same needle which was used in mixing the ephedrine novocain for infiltration; thus sufficient ephedrine was present to cause a delay in the absorption of the combined anesthetic agent. The solution was further diluted up to 2½ to 3 c.c. with spinal fluid, before injection into the subarachnoid space took place; then the patient was placed in a supine position until the surgeon was ready to make the incision. The patient was shifted to a 25 degree Trendelenburg position and 2 c.c. of 2½ per cent pentothal were injected intravenously as the incision was made. The amount of pentothal sodium solution given was only sufficient to keep the patient in a degree of sedation comparable to a normal sleep. Oxygen was given to avoid the depression of pentothal.

The presence of dyspnea, especially of cardiac origin, was considered a contraindication to the use of pentothal. In none of the 66 cases reported was resuscitation of the baby necessary. The author presents 3 cases in which the use of the combined anesthetic was indicated. This combination seems to produce adequate anesthesia with a subanesthetic dosage of all drugs used. Side effects and postoperative complications were reduced to a minimum.

MARY KARP, M.D.

**Seconal as a Basal Anesthetic for Children.** MARY FRANCES POE and MARY KARP. *Current Res. Anesth.*, 1948, 27: 88.

In an attempt to alleviate the psychic trauma of a child undergoing surgical intervention, four groups of patients involving 100 cases were given varying proportions of seconal and atropine, or seconal and demerol. The medication evolved combines the dosage of seconal of approximately .05 gr. per pound plus demerol and atropine sulfate. A total of 3 gr. of seconal was not exceeded for it was the intention to produce sedation only in the older child.

**Pontocaine Hydrochloride for Brachial Block Analgesia: 150 Cases.** DANIEL C. MOORE. *Anesthesiology*, 1948, 9: 281.

Brachial block has become a favorite type of anesthesia for operations on the hand. From 5 to 6 hours' operating time was obtained with brachial blocks in which 0.1 per cent or 0.15 per cent pontocaine solutions were employed. Anesthesia was established in from 20 to 40 minutes. Sensory loss occurs ten to twenty minutes before muscular movements are abolished. Successful blocks were obtained in 96 per cent of the cases.

Postoperatively, there is no need for an opiate until a period of 6 to 8 hours has elapsed. No complications or injuries to the brachial plexus have occurred from the prolonged action of the pontocaine. Up to the present time no untoward effects have occurred during or following the use of pontocaine. Some of the unpleasant effects of procaine and epinephrine have not been noted. When spinal anesthesia is used with brachial block, pontocaine is the drug of choice because of its lasting effects.

MARY FRANCES POE, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**Roentgenological Manifestations of Intrathoracic Injury Due to Missiles.** WILLIAM A. EVANS, JR. *Am. J. Roentg.*, 1948, 59: 662.

This study is based on observations made in the x-ray service of an overseas General Hospital of the United States Army. During a period of 6 months 4,040 battle casualties were admitted, approximately 5 per cent of whom had wounds involving the intrathoracic structures.

Roentgen manifestations of thoracic injuries are usually multiple. The most common findings are: (1) foreign bodies in the lung, (2) lesions of the pulmonary parenchyma, (3) pneumothorax and hemothorax, and (4) lesions and foreign bodies in the mediastinum.

*Foreign bodies.* Metallic fragments lying in the substance of the lung are seen frequently. In a large proportion of the cases there is no other evidence of injury to the pleura or lung parenchyma and even after prolonged periods no reaction in the adjacent tissues develops. Not infrequently foreign bodies penetrate close to the mediastinum or hila. The question arises whether in such instances pulsations transmitted to them may not produce a delayed perforation. This hazard must be balanced against the hazard of their operative removal.

*Traumatic pneumonia.* In several cases an area of infiltration has been observed along the path of the missile suggesting a traumatic origin. The infiltration was rather diffuse in the beginning, then it became sharply circumscribed, of spherical or ovoid shape, and within a few weeks it completely disappeared. Such a lesion most probably represents a hemorrhagic infiltration from rupture of a large blood vessel with subsequent clotting, organization, and resolution.

*Pleural manifestations.* The most common and most serious complications due to intrathoracic injury have been hemothorax and pneumothorax, usually occurring together. Under favorable circumstances the air and exudate will disappear in 2 or 3 weeks. If resolution has not occurred after this critical period of 2 weeks, a greatly prolonged course may be anticipated with irreversible changes as sequelae. The blood in the pleural cavity acts as an irritant, provoking an outpouring of serofibrinous exudate from the pleural surfaces. Later there is formation of fibrin clots with thickening of the pleura over a collapsed lung. The amount of pleural exudate may continue to increase despite repeated aspirations. In such instances more radical measures become necessary to evacuate the pleural space. If the lung has been collapsed over a long period, thoracoplasty may eventually have to be performed.

An interesting observation was the marked tendency to encapsulation of the pleural contents after the critical period. The encapsulated pocket or pockets, as a rule, formed posteriorly due to the recumbent position of the patient.

Rarely, interstitial emphysema of the chest wall was noted. It was thought that in case of tension pneumothorax the air escapes through a rent in the parietal pleura, accounting for the interstitial emphysema. A complete collapse of the lung and a marked displacement of the mediastinum are strongly indicative of a tension pneumothorax. When both air and exudate escape from the pleural space cellulitis and abscess formation of the chest wall are likely to result.

*Mediastinal involvement.* Cases of foreign bodies in the mediastinum have been rare since the large majority of such injuries are rapidly fatal from hemorrhage. In those patients who survived, a decision as to a later surgical removal of the foreign body was most difficult. Cases have been observed in which a late perforation of a large vessel occurred apparently from a slow erosion produced by vascular pulsation. The presence of a large cardiac shadow in patients with missile injuries of the thorax raises the suspicion of a pericardial effusion.

The author gives the brief histories of 14 more or less typical cases in which numerous roentgenograms were used for illustration. T. LEUCUTIA, M.D.

**Roentgen Examination in Acute Dilatation of the Stomach.** J. FRIMANN-DAHL. *Acta radiol.*, Stockh., 1948, 29: 237.

The author presents the roentgen findings in 20 cases of acute dilatation of the stomach to demonstrate some of the most characteristic forms of this condition.

The acute gastrectasias may be divided into the following groups: dislocations and anomalies, primary organic stenosis, secondary stenosis, and functional stenosis. According to this grouping gastric dilatation is capable of primary occurrence as an independent disease, or it may occur secondarily, in which case it must be regarded as purely symptomatic.

The condition of acute dilatation of the stomach is demonstrated on roentgenograms taken upright, supine, and in lateral decubitus, with or without peroral barium. The dilated stomach with fluid level or levels is visualized.

The group of dislocations and anomalies included a case of gastric volvulus, 2 cases of diaphragmatic hernia, and a case of arteriomesenteric obstruction. The group of organic stenoses of the stomach included 3 cases of pyloric obstruction and 2 cases of acute phlegmonous gastritis, which showed marked dilatation of the stomach. The secondary dilatations of the stomach included several cases due to inflammatory processes in the vicinity of the pylorus, such as cholecystitis and pancreatitis.

Clinically, many of the cases of gastrectasia simulate perforated ulcer, ileus, or volvulus of the bowel.

FRANK L. HUSSEY, M.D.

**Roentgen Considerations of Pyelonephritis in Small Kidneys.** EUGENE P. PENDERGRASS, RICHARD H. CHAMBERLAIN, and FRANK P. BROOKS. *Am. J. Roentg.*, 1948, 59: 651.

The newer discoveries in regard to the relationship between renal pathology and arterial hypertension have created considerable interest as to the significance of unilateral small kidneys. In interpreting urograms the authors for some time paid attention not only to the gross morphologic changes but to the physiologic and pathologic abnormalities as well. They now report on the result of such analytical observation in the unilateral small kidney, with special reference to the findings in atrophic chronic pyelonephritis.

The following scheme of analysis was pursued by the authors

1. Gross anatomy of the kidneys
   a. Position, size, shape, and axis of the kidneys
   b. Density of the kidney shadow
   c. Delineation of the kidney from surrounding structures
   d. Mobility of the kidney as a whole
2. Roentgenologic quality of clearance of the contrast media
   a. Selection of contrast medium for testing of tubular or glomerular function or both
   b. Comparison of clearance from both kidneys
   c. Comparison of urea clearance with skiodan excretion
   d. Determination of delay in excretion
3. Anatomy of the renal pelvis and calices
   a. Number and configuration of the calices
   b. Character of the filling
   c. Position of the renal pelvis, intrarenal or extrarenal
   d. Relative proportion of the medulla and cortex
4. Physiology of the renal pelvis and calices
   a. Character of the peristalsis
   b. Elasticity of the pelvic structures and consideration of the reversibility of any dysfunction
   c. Disturbance in emptying.

*Pathology of unilateral small kidney.* A significant smallness in size of a kidney may be the result of malformation in development, of atrophy from acquired disease, or of both. It is not possible to make the distinction between the two types clinically. It was hoped that roentgenologic means might lead to a better result. However, the differential features in certain cases appear too subtle to be of value, although pertinent indications as to the nature of the abnormal kidney may be shown.

*Hypoplasia of the kidney.* This is defined as a kidney which is small as a result of defective development but which contains functioning normal tissue. Its incidence at autopsies has been quoted as varying between 1:600 and 1:3,000.

*Acquired atrophy.* The most important diseases responsible for an acquired unilateral renal atrophy are: (1) atrophic chronic pyelonephritis, (2) primary atrophy, and (3) pyonephrosis.

Atrophic chronic pyelonephritis represents the most frequent cause. Hage, for example, reported 69 contracted pyelonephritic kidneys in 9,888 autopsies. The mode of its pathogenesis is difficult, if not impossible, to evaluate by any means, except for the classical division into the ascending and hematogenous forms. The basic pathologic change of a small pyelonephritic kidney is characterized by cortical scarring which has replaced glomerular and tubular structures, with corresponding thinning of the cortex. On urographic examination this change is manifested by the demonstration of fixation, loss of elasticity, and loss of peristalsis.

A primary atrophy of the kidney is observed rarely. It may occur in anuria from obstruction, but the unique mechanism of hydronephrosis is the usual reaction of the kidney to such obstruction.

Pyonephrosis is defined as a secondarily infected hydronephrosis. The small kidney resulting from this condition is indistinguishable pathologically and roentgenographically from atrophic chronic nephritis.

*Roentgenologic considerations.* This division of the origin of the small kidney appears to be rational but, from the roentgenologic standpoint, there are the following interesting observations which are difficult to explain: (a) the small kidney with or without urographic evidence of pyelonephritis found on the first examination in every case studied by the authors except one which showed a small diminution in the size of the kidney after 4 years; (b) the fact that the condition has occurred in both children and adults; (c) many cases of pyelonephritis are observed in which the kidneys are not small, and in bilateral pyelonephritis only one kidney has appeared to be small in practically every instance; and (d) small kidneys, presumably hypoplastic, were observed in patients in whom there was no clinical evidence of disease.

The authors found altogether approximately 60 cases of unilateral small kidney. In addition to the diminution in size, there was often an unusually sharp demarcation of the renal contour from the surrounding soft tissue densities. The mobility of the kidney as a whole was restricted in many cases, such fixation probably being the result of capsular inflammatory changes. The ability to clear the intravenous contrast medium was frequently impaired.

Some information was also gained from a study of the anatomic aspects of the renal pelvis and calyces, from an evaluation of the relative proportion of the medulla and cortex of the kidney, and from a serial examination of the physiology of the renal pelvis and calyces in the supine, Trendelenburg, and semierect positions, best accomplished with the excretory contrast method.

Ten illustrative cases are briefly reported with reproduction of the respective roentgenograms.

T. LEUCUTIA, M.D.

**Bone and Joint Lesions in Leprosy. A Radiologic Study.** GONZALO ESGUERRA-GÓMEZ and EMILIO ACOSTA. *Radiology*, 1948, 50: 619.

An extensive roentgenographic analysis was made of the hands and feet of 532 patients. Of this group, 483 were known to be afflicted with leprosy, 5 were suspects, and 44 were normal.

The leprous patients were classified, according to the International Congress of Leprosy (1938), as neural or lepromatous (cutaneous) types. The two groups were subdivided as minimal, moderate or advanced, with a mixture of the main groups as well.

Of the 483 leprous patients, 365 were males and 118 females. The ages of patients ranged from infancy to 90, the incidence being greatest in patients between 30 and 50 years of age.

Decalcification and rarefaction, producing a vacuole appearance, were frequently observed in the epiphyses of the phalanges, and in the metacarpal and the metartarsal bones. In some instances, the cortex expanded and ruptured under pressure. Vacuole appearance is due to nerve damage or to the growth of Hansen's bacilli in the bone marrow and osseous tissue. Decalcification may be caused by impaired circulation due to destruction of sympathetic fibers of the nutrient arterioles, nerve disorder due to poor condition of afferent nerves, and disturbed calcium metabolism. The results of disturbed calcium metabolism remain contradictory and doubtful.

Hypertrophy and hyperostosis occur at the articular ends of the phalanges, the metacarpal, or the metatarsal bones, and produce deformities. In some instances the bony deformity is hooded.

Reabsorption may be of a simple type or may follow atrophy. It occurs in both the neural or cutaneous types of the disease. Simple reabsorption appears as an osteitis of the distal phalanges. Small erosions may be seen. This type of absorption begins with an onychia. The proximal end of the phalanx may become involved and produce an increased density and expansion of the phalanx, so-called "hood." Eventually the bone is destroyed and the joint is involved.

Reabsorption following atrophy produces a thin distal phalangeal diaphysis which tends to become conical in shape. The appearance at one stage may resemble a collar button; eventually only the proximal portion of the phalanx remains with a hood image. Middle phalangeal involvement is characterized by a "diabolo" form. Fractures are frequent. Proximal phalanges show joint distortion and muscular atrophy.

Mutilation may affect all four extremities, stopping at the carpus and Lisfranc's articulation. Perforating plantar ulceration of the anterior inner aspect of the foot, with bone changes suggesting osteomyelitis may also occur. However, epiphyseal location at the first metatarsal and proximal phalanx, plus soft tissue destruction, should be sufficient to warrant a diagnosis of leprosy. Healing takes place through ankylosis. Osteomyelitis (whitlow type) can be differentiated from a true osteomyelitis by the absence of pain.

Of the 483 lepers examined, 306 presented radiological evidence of involvement of the hands and feet. Of the remaining 177 patients, 68 per cent showed suggestive but not conclusive roentgen findings of leprosy. MAURICE D. SACHS, M.D.

**Atlanto-Occipital Fusion, Ossiculum Terminale and Occipital Vertebra as Related to Basilar Impression with Neurological Symptoms.** LEE A. HADLEY. *Am. J. Roentg.*, 1948, 59: 511.

The author presents 6 cases of congenital anomalies occurring at the foramen magnum. In 1 case the condition was an occipital vertebra, in 4 cases, undoubtedly, atlanto-occipital fusion, and in 1 case the features of both were present. In 5 of the patients, asymmetry with tilting of the head was shown, and in 4, foramen distortion. Several other anomalies were present in these cases.

In occipital vertebra, the atlas is present and the malformations surround the foramen magnum. There may be hypochondral arch, partially or completely fused to the anterior margin of the foramen magnum; this may bear a third condyle for articulation with the odontoid. This condyle may be either an articular depression or a single tuberosity with an articular facet. Bilateral bony masses or accessory eminences may encroach upon the anterior part of the foramen magnum. These various bony tuberosities and masses develop in the ligamentous tissue about the foramen. A partial or complete neural arch may be outlined about the dorsal surface of the foramen. Transverse processes may or may not be present, more or less fused with the bones of the skull. If present, they do not bear a foramen for the vertebral artery. The condyles resemble those of the normal subject and an ossiculum terminale may be present.

In atlanto-occipital fusion the differentiating value is the shape of the condyles. On the occipital vertebra these are oval and convex, and in the anteroposterior view their articular surfaces face laterally in a caudal direction. The condyles on the undersurface of an assimilated atlas, however, are flattened and their surfaces, visualized in the anteroposterior view, are directed medially in a caudal direction. In a case of atlanto-occipital fusion, the articulation above the atlas is lacking on one or on both sides. Flexion-extension studies will reveal a fixation of movement between atlas and occiput. The transverse processes bear foramina for the vertebral arteries. There is a space between the dorsal arch of the atlas and the occiput for passage of the suboccipital nerve and the vertebral artery. There is an articulation on the anterior arch for the odontoid. As with the occipital vertebra, the accessory eminences on one or both sides may encroach upon and distort the foramen magnum. The anterior arch or the posterior arch may not be completely fused with the occiput. Nonsegmentation may have occurred only on one side.

Good stereoscopic reontgenograms are much superior to planigrams. A lateral survey film with the head at full limit of the forward flexion should detect nearly all cases. The foramen magnum may be visualized by either the vertex-occiput or the occiput-vertex projections with some distortion. Other films to visualize the odontoid process, the planes of the atlanto-occipital and the atlanto-axial articulations are taken.

Early operation offers the promise of arresting the progress of the condition, although restoration of normal relationships is impossible. If a congenital anomaly of the above types is discovered in a young child not yet showing symptoms, the parents should be acquainted with the possibilities and remain alert for the first appearance of neurological signs. These may not appear until the second or third decade.

FRANK L. HUSSEY, M.D.

**A Method of Roentgenologic Examination of the Shoulder.** WILLIAM E. HOWES and B. BRUCE ALICANDRI. *Radiology*, 1948, 50: 569.

Routine roentgenograms of the shoulder girdle, namely, the anteroposterior views with the hand in external and internal rotation, in many instances are not adequate to warrant an accurate diagnosis.

Anatomic studies of the skeleton were made in an effort to determine the insertion areas of the short rotators and of the subscapularis tendon. It was soon obvious that the best way to demonstrate calcifications or chip fractures would be through the use of multiple tangential views. The following five views were found to be necessary:

1. To demonstrate the infraspinatus tendon, the shoulder is elevated at a 23 degree angle with the hand in external rotation.
2. To demonstrate the supraspinatus tendon, the angle board is removed and the hand is held in supination.
3. To demonstrate the teres minor tendon, the hand is held in internal rotation.
4. To demonstrate the subscapularis tendon (axillary view with the patient sitting), the arm is held in abduction; the central ray is angled medially and cephalad through the axilla.
5. To demonstrate the bicipital groove and tuberosities, the hand is held in supination and the main ray is directed from the elbow medially and cephalad at a tangent toward the bicipital groove.

By utilization of multiple tangential views accurate localization of calcifications or fractures can be established.

MAURICE D. SACHS, M.D.

**Tumor Dose in Cancer of the Larynx.** CHARLOTTE P. DONLAN. *Radiology*, 1948, 50: 463.

The technical factors, dosage, and results of the treatment of cancer of the larynx reported by Blady and Chamberlain, Howes and Platau, and Cutler are compared with those of the treatment of 113 patients with cancer of the larynx at the Radiotherapy Department of the Presbyterian Hospital, New York, from April 27, 1928 to November 21, 1944.

During this period, the technique and dosage varied considerably in the author's series. In the latter part of this period, she used 200 kv. 25 ma. 50 cm. STD, and 1 mm. of copper plus 1.25 mm. of aluminum filter were used. The average daily dose was 125 roentgens in air to each of two lateral portals 7 cm. in diameter. Earlier, she used 10 by 10 fields with an average daily dose of 350 roentgens in air.

The total tumor dose in the author's series and the various other reported series closely approximated 5,000 roentgens.

Comparison of the results obtained in the author's series showed very little difference between the techniques used in the earlier and later cases. The results of the various authors are also similar, except that Cutler reports a larger percentage of 5 year cures with 400 kv. and two treatments daily.

VERN W. RITTER, M.D.

**Mammary Cancer.** G. E. RICHARDS. *Brit. J. Radiol.*, 1948, 21: 249.

The author discusses some radiotherapeutic procedures currently used in the treatment of mammary cancer. These include: (1) teleradium therapy, (2) 200 kv. roentgen therapy, and (3) 400 kv roentgen therapy.

In 1933, the treatment of primary carcinoma of the breast by means of teleradium was commenced at the Ontario Institute of Radiotherapy, in Toronto. A 4 gm. radium element (salt) unit was used. Concomitantly a similar group was treated with 200 kv. roentgen therapy for comparison. In none of the patients so treated was cancer eradicated from the breast. This was rather disappointing, especially as it concerns the radium, but perhaps the small size of the beam limiting its usefulness to small primary lesions might explain the cause of the failure.

In 1938, 400 kv. roentgen therapy was introduced. The skin and tissue reactions from this type of treatment were found to be much less troublesome and the method has resulted in eradication of cancer in 17 per cent of the cases; therefore the author is convinced that 400 kv. roentgen therapy has many points of superiority over either the teleradium or the 200 kv. roentgen therapy.

In the treatment of the primary tumor, wherever possible 4 converging tangential portals of 10 by 20 cm. are used: superior, inferior, mesial, and lateral. Doses have been calculated for two planes; (a) plane X, which represents the junction of the middle and outer thirds of the breast and (b) plane Y, which represents the base of the breast just overlying the pectoral muscles. From the attached dosage charts it can be seen that if 200 kv. are used and a dose of 1,500 roentgens is administered per portal, plane X will receive a total of 2,430 to 3,240 roentgens, whereas with 400 kv. and a dose of 1,800 roentgens per portal it will receive approximately 3,500 roentgens. Under identical conditions, plane Y will receive a total of 1,870 to 2,240 roentgens and about 3,500 roentgens respectively. Since the average cancericidal dose must reach approximately 5,000

roentgens the doses given must be considered, despite the excessively severe skin reactions, as still being too small to eradicate every cancer from the breast.

Treatment of the axilla. For this purpose 3 portals are used: an anterior, a posterior, and a direct portal into the axilla, with the arm abducted as fully as possible. With 3 such portals, each receiving 1,200 roentgens, the depth dose in the center of the axilla will be 2,000 roentgens, which is too small. By using an additional superior portal directed downward from the point of the shoulder the dose in the apex of the axilla is raised to 3,500 roentgens. The results obtained by such technique amounted to 35 per cent.

Treatment of the supraclavicular area. Here teleradium therapy is used to advantage. A 6 cm. circular beam is directed from several converging angles into the supraclavicular triangle, effecting a fairly satisfactory crossfire technique. By this means 50 per cent of the palpable nodes were made to completely disappear. Next to teleradium therapy in effectiveness is the 400 kv. roentgen therapy. With this agent 3 portals are used for cross-firing: an anterior oblique (which also includes the infraclavicular space), a superior lateral direct, and a posterior oblique portal. A cone 6 by 8 cm. is employed, the doses ranging from 900 to 1,500 roentgens per portal, depending upon the individual skin tolerance.

Dosage charts are given (1) for the treatment of the primary tumor, indicating (a) the dosages through plane X at 400 kv. and 200 kv., and (b) the dosages through plane Y at 400 kv. and 200 kv.; and (2) for the treatment of the axilla, (a) if 3 portals are used, showing the dosages at 400 kv. and 200 kv., and (b) if 4 portals are used, showing the dosages at 400 kv. and 200 kv. T. LEUCUTIA, M.D.

**The Influence of Castration with Roentgen Rays on Carcinoma of the Breast.** VIGGO E. THAYSSEN. *Acta radiol.*, Stockh., 1948, 29: 189.

The author compares the results of treatment of 99 patients with breast cancer and metastases or recurrences who were treated at the Radium Center in Copenhagen by roentgen-ray irradiation over the ovaries, with the results in a similar group of 100 patients who were not subjected to castration. The 99 patients were given both local treatment of the primary tumor and the metastases, and roentgen treatment of the ovaries at some time or other after the appearance of the metastases, whereas the 100 patients received only local treatment.

Of the 99 castrated, 72 were treated with roentgen rays before the menopause; the remaining 27 were treated during the menopausal change or until 12 years after this period. The youngest patient was 26 years old at the time of castration, the oldest 59. All of the patients in the first group of castrates menstruated regularly, but those in the second group had either shown signs of an incipient menopause or their menses had definitely ceased. The castration was accomplished with two routine doses of 250 roentgens on each of four fields (10 by 15 cm.) on the lower part of the abdomen, two anterior and two posterior, with 180 kv., 15 ma., a distance of 40 cm., and a filter of 0.5 of copper. In 24 cases 1,000 roentgens were given to four fields, but seemingly without greater effect than the other doses. There were metastases in all of the cases at the time of castration.

In the 100 noncastrated patients the treatment with roentgen rays to recurrences and metastases was essentially the same as in the castrated ones. The average age of the 100 patients was 45.6 years, corresponding to an average age of 43.5 years for the castrates.

Of the castrated patients 40 per cent had a survival of 2 years or more after their appearance, while the corresponding figure for the controls was only 11 per cent. After 5 years, 20 per cent of the castrated patients were still alive, while all of the patients in the control group had died. Of 74 who had received roentgen treatment before or after operation and had been castrated, 28 per cent were alive 5 years after the operation, as against 8 per cent of the controls.

On the basis of 79 urine assays, 41 for gonadotropin and 38 for estrogen, it was shown, among other things, that the castration may have had a highly beneficient effect even in cases in which the estrogen output was low before castration.

Castration therapy is not certain to prove effective, but it may be concluded that in one-third of the cases it will result in temporary improvement of the patient's condition. It may be the means of obtaining some additional years of life in relative comfort for the patient and it may also prolong life to some extent. FRANK L. HUSSEY, M.D.

**Roentgen Treatment of Cancer of the Esophagus.** JACOB R. FREID. *Am. J. Roentg.*, 1948, 59: 551.

The author re-evaluates the present-day treatment of cancer of the esophagus and describes his experience with roentgen therapy at Montefiore Hospital. He reports the case of a patient who is well more than 7 years following roentgen therapy.

A review of the literature shows that in operable cases surgery is the treatment of choice. However, since by far the majority of these growths are inoperable, roentgen radiation constitutes the most commonly used treatment.

Contraindications to the use of radiation therapy are: (1) infection, (2) severe anemia, and (3) cachexia and emaciation.

The methods of irradiation include: (1) interstitial radon seeds, (2) intracavitary radium tubes, (3) telecurietherapy, (4) roentgen therapy, and (5) the combined technique consisting mostly of an association of radium therapy with external roentgen therapy.

The factors governing the response of the esophageal carcinoma to irradiation are: (a) radiosensitivity, (b) clinical character of the neoplasm; (c) stage of the disease; (d) accessibility, and (e) previous treatment.

At Montefiore Hospital, the following method of irradiation is used: 200 kv. or 400 kv. (the latter

being preferred); 3 anterior and 3 posterior portals, with the patient lying flat or being in a sitting position; 100 roentgens with 400 kv. to each of the six fields daily until a tumor dose of 6,000 to 7,000 roentgens is reached in 6 weeks; or 500 roentgens with 200 roentgens to two or more fields, for a period of 6 weeks. Under ideal conditions, the daily dose to the tumor should be approximately 200 roentgens and not less than 150 roentgens.

The complications and injuries include: (1) severe changes in the lungs and mediastinum following intensive irradiation; (2) dysphagia following well planned irradiation, which may be due to scar formation and contraction of the esophagus; (3) aggravation of coexistent pulmonary and mediastinal tuberculosis; and (4) perforation complicating fractionated roentgen therapy of moderate dosage. Examples of all these possibilities are given and illustrated with roentgenograms.

The number of patients treated was 13. With the exception of one, all received roentgen therapy exclusively. The average survival from the time of treatment amounted to 11 months as compared to the 5 to 8 months' survival from the onset of symptoms quoted in the literature for nontreated patients.

Autopsies, some time after irradiation, were performed on 4 patients. In 3 of the patients there was no evidence of carcinoma, and in the fourth patient only a few degenerating carcinoma cells were found. The one patient who is well after a period of 7 years is from the author's private practice. This case is described in detail.

A bibliography of 23 articles is appended.

T. Leucutia, M.D.

**Primary Tumors of the Small Intestine.** Carroll C. Dundon. *Am. J. Roentg.*, 1948, 59: 492.

The author reviews 62 cases of tumors of the small bowel from the records of the University Hospitals of Cleveland, for the years 1933 to 1946.

Eighteen cases of malignant tumors were recorded; in 13 of these the patients had symptoms referable to the gastrointestinal tract, or had a palpable mass in the abdomen. The incidence was 1 tumor to 3,000 admissions on the surgical service, or 1 tumor to 9,000 general hospital admissions.

There were 44 benign tumors, only 2 of which caused clinical symptoms; these 2 were pedunculated and caused intussusception.

Of the 18 malignant tumors, 3 were found in the duodenum, 8 in the jejunum, and 7 in the ileum. (Tumors of the ampulla of Vater are not included in this report.) There were 12 carcinomas—3 in the duodenum, 5 in the jejunum, and 4 in the ileum. Two lymphosarcomas and 1 leiomyosarcoma occurred in the jejunum. One fibrosarcoma and 2 malignant carcinoids were found in the ileum.

The average age of the 18 patients with malignant tumors was 48 years, and the age range was from 21 to 76 years. There were 10 males and 8 females. The chief complaints of the 18 patients with malignant tumors of the small intestine were abdominal pain in 9 cases, vomiting in 2 cases, and diarrhea and weakness in 1 case each.

Six patients had no symptoms referable to the gastrointestinal tract, although 1 of these had a large abdominal mass. Abdominal pain existed in 9 of the 18 patients for an average period of 12 months. Nausea and vomiting occurred in 5 patients, with an average duration of 11 weeks. Mild and intermittent diarrhea existed in 3 cases for an average period of 9 months. Five patients had melena; in 2 of these the melena was severe, having appeared as a terminal event and as the immediate cause of death. Intussusception occurred in 4 cases. A tumor mass was palpable as an abdominal mass in 6 patients. Loss of weight was severe in most cases.

Eight of the malignant tumors were infiltrating in type and 9 were polypoid. Three of the polypoid tumors were pedunculated.

Necrosis of the tumor with ulceration and hemorrhage developed in 5 cases.

Both of the patients with lymphosarcoma had two foci of involvement.

Metastases or local extension to adjacent organs had occurred in 16 cases when the tumors were discovered. Distant metastases of the lung and brain were found in 1 case each before the primary tumors were discovered.

A review of the roentgenograms revealed definite changes in 8 cases which might have led to a correct diagnosis if complete studies had been made.

Eight patients had barium studies. Four showed narrowed loops of small intestine; 2 had complete obstruction to the passage of barium through the jejunum; 1 showed dilatation of the intestine at the site of the lesion, and 1 patient had marked hypermotility.

The author states that patients who have persistent abdominal pain, either intermittent or constant, and patients with vomiting, melena, or diarrhea which remains undiagnosed after routine studies of the gastrointestinal tract, gall bladder, and urinary tract, deserve special study of the small intestine to exclude a primary tumor.

Frank L. Hussey, M.D.

**Roentgen Treatment of Multiple Myeloma.** L. Henry Garland and Bayles R. Kennedy. *Radiology*, 1948, 50: 297.

The authors review the literature and the results in a series of 13 cases of multiple myeloma which were treated by the use of roentgen therapy to determine the value of this type of therapy. Eight of the cases were proved microscopically and 5 had sufficient clinical, laboratory, and x-ray evidence for the diagnosis. Six of the patients treated showed improvement in their condition, 6 were not appreciably benefited, and one had incomplete treatment. One of the patients survived more than 9 years and is still living. The average survival for the remaining treated patients was 10.4 months, while that of the untreated patients which the author mentions was 2.3 months.

The physical factors were as follows: 200 kv., half value layer of 1.2 mm. of copper. The target skin distance and field size varied according to the sites treated (commonly used distances were 70 cm., and the fields were 20 cm. in diameter). The dose in roentgens was measured in air without backscatter. The dosage that the patients received varied considerably. It is believed that adequate irradiation of patients with multiple myeloma is still worth attempting.

Multiple myeloma is not a radiosensitive disease. Solitary myeloma appears to be radiosensitive and a radio-controllable disease in certain instances and should be treated by vigorous roentgen irradiation when the diagnosis is established microscopically. Multiple or solitary myeloma with spinal cord compression and paresis or paraplegia appears to be well worth irradiation (following laminectomy). In the literature, survivals for as long as 7 years have been recorded.

FRANK L. HUSSEY, M.D.

**Roentgen Therapy in Traumatic Myositis Ossificans.** ERNST A. POHLE and CAROL TOMLINSON. *Am. J. M. Sc.*, 1948, 215: 372.

The authors review the etiology, pathology, pathogenesis, and clinical findings in traumatic myositis ossificans.

After pointing out that early surgical removal is usually contraindicated because of the possibilities of recurrence, they describe their technique of roentgen therapy for this condition. With 175 or 490 kv., 50 cm. focal skin distance (half value layers of 1.05 mm. of copper and 2.4 mm. of copper), they deliver doses of from 150 to 200 roentgens in air to one or two fields daily or every other day for 3 or 4 treatments. A second series in from 4 to 6 weeks was given in some cases, and a third series in from 2 to 4 months after the first course was occasionally necessary.

They have treated 10 patients with relief of pain in all of them. This was often noted 2 or 3 days after treatment and always after from 4 to 6 weeks. In most of the cases there was a slight decrease in the size of the calcified area. Limitation of motion showed marked improvement.

The authors believe that these beneficial results in a small series justify further trial of roentgen therapy in traumatic myositis ossificans.

JOHN O. LAFFERTY, M.D.

**Lymphoid Tumors.** HUGH F. HARE, WILLIAM C. MULRY, and C. FRANKLIN SORNBERGER. *Radiology*, 1948, 50: 506.

The authors believe that early diagnosis and treatment of lymphoid tumors constitute the only approach to success in the treatment of lymphoid tumors. In a series of 181 cases diagnosed clinically and histologically as lymphoid tumors, during the years 1934 to 1942 inclusive, 50 patients, (29 per cent) were living and well at the end of 5 years and 2 others were living with recurrence of their disease. During the period of observation, 30 per cent of the patients had recurrent involvement of nodes locally or at a new site requiring treatment. Thirty seven, or 71 per cent of the 52 patients living, showed no recurrence following the initial treatment during the 5 year period of observation. The results, then, would indicate that if the disease is adequately treated when localized, a significant number (29 per cent) will obtain a 5 year survival.

The onset of lymphoid tumors is insidious. In approximately 61 per cent of cases, it is first noted as an enlargement of the lymph nodes in the neck. The enlarged nodes frequently follow an upper respiratory infection and subsequently recede only partially, or not at all. The disease may originate in any part of the body and may become generalized before diagnosis is considered. It is important that a biopsy specimen be taken in each instance as soon as the nodes are discovered. All of the enlarged glands in cases of Hodgkin's disease do not reveal evidence of the disease. Roentgen therapy may be used as a method of diagnosis when the nodes are not accessible for biopsy.

Irradiation of localized lymphoid tumors must be directed to all palpable nodes and to the area surrounding the tumor bed, with a total dosage of 2,400 roentgens delivered to the tumor; 200 kv.p., with copper filtration, half-value layer 1.6 mm. copper, is used. Mediastinal involvement may be of the scirrhous type, and at least 1,200 to 1,500 roentgens should be delivered to the tumor in the first course to establish the diagnosis. Two weeks after treatment comparative roentgenograms are made and if the lesion is considered to be radiosensitive, treatment to the fullest extent should be carried out. Localized disease of the gastrointestinal tract is the most amenable to surgery. The treatment of generalized disease in most instances is for palliation only; 1,200 to 1,550 roentgens measured in air is usually sufficient to bring about palliation and shrink the nodes enough to relieve pressure symptoms. Supportive measures and treatment of other symptoms should also receive attention.

FRANK L. HUSSEY, M.D.

**Engelmann's Disease.** H. R. SEAR. *Brit. J. Radiol.*, 1948, 21: 236.

The rare congenital bone dystrophies associated with osteosclerosis fall into five main groups as represented diagrammatically in Figure 1. They are:

1. Osteopetrosis, or marble bones
2. Engelmann's disease, or osteopathia hyperostotica sclerotisans multiplex infantilis
3. Melorheostosis, or Leri's disease
4. Osteopoecilia, or spotted bones
5. Punctate epiphyseal dysplasia, or spotted epiphyses

Engelmann's disease is the rarest of these, this being the first reported case since Engelmann's single case in 1929. His case was that of an 8-year-old boy of whom roentgenograms showed bilateral symmetrical expansion, and thickening and sclerosis of the diaphyses of all the long bones. No involvement

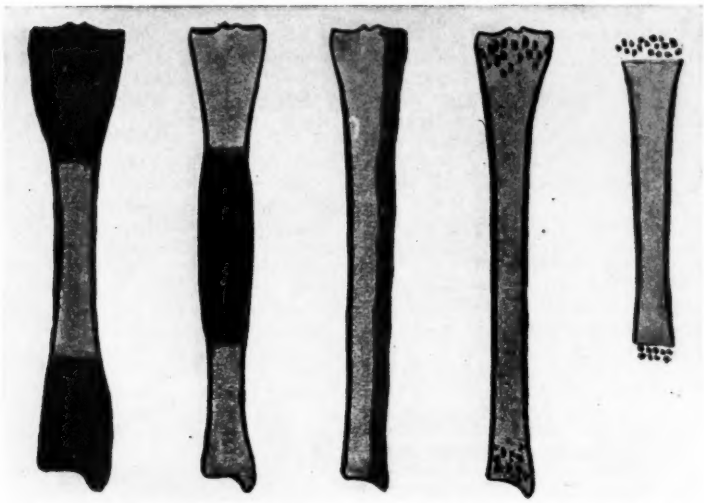

Fig. 1. (Sear). Rare congenital bone dystrophies associated with osteosclerosis.

of the ends of the diaphyses or epiphyses was present. The skull showed thickened patches in the frontal bone and base of the anterior and middle cranial fossa, and thickening and sclerosis of the orbital roofs. The child showed a stature below normal with apparent lengthening and bowing of the legs, a short neck, flat feet, and lumbar lordosis. No other gross abnormalities were present and the history and laboratory studies were not significant.

Sear's case was that of a boy 10 years old of whom roentgenograms also showed dense osteosclerosis of the central portions of the shafts of the long bones, especially pronounced in the clavicles, forearms, femora, and tibia. The skull showed dense thickening and osteosclerosis of its base extending into the frontal bone. A history of some difficulty in walking from the age of 3 years was elicited and marked wasting of the leg muscles giving an apparent leg lengthening was noted. Biopsy showed very dense but essentially normal bone structure. Laboratory findings were not significant.

Engelmann's disease is differentiated from osteopetrosis, which gives a similar appearance in the skull by the central involvement of the long bones, sparing the ends of the diaphyses and epiphyses, and also by the absence of changes in the vertebrae, ribs, and bones of the hands and feet.

Infantile cortical hyperostoses of Caffey and Silverman is a disease of infancy characterized by sudden onset, fever, asymmetrical bony involvement, and slow return to normal. The mandible is most likely to be involved in the skull. The bone lesions are accompanied by painful soft tissue swelling. This is in contrast to the symmetrical involvement, changes in the base of the skull, and persistence of the lesion for 8 to 10 years which were seen in these 2 cases of Engelmann's disease, the rarest of the congenital condensing bone dystrophies.

ALLAN K. BRINEY, M.D.

## MISCELLANEOUS

**Effects of Radioactive Sodium on Leucemia and Allied Diseases.** T. C. EVANS, M. LENZ, C. P. DONLAN and M. J. LEMAY. *Am. J. Roentg.*, 1948, 59: 469.

The authors present a report of the results obtained following the use of radioactive sodium in the treatment of 24 patients with leucemia and allied disorders. The amount of radiosodium excreted was found to be less than 10 per cent of the dose administered. The percentage of radiosodium excreted appeared to be related to the individual patient rather than to the amount of radiosodium administered, or to the amount of urine excreted. The distribution of radiosodium was determined by examining the tissues taken at autopsy from 2 patients who died about 48 hours after the administration of radiosodium. No marked concentration of radiosodium was observed in any of the tissues, although the concentration was somewhat higher in the vertebra, liver, and kidney, and slightly lower in the muscle and intestine.

With regard to the 5 preliminary cases in this series (1 patient in the terminal stage of Hodgkin's disease, 3 patients in the terminal stage of lymphosarcoma, and 1 patient in the terminal stage of myelogenous leucemia), the results were such that the authors were encouraged to carry out additional studies on the treatment of chronic leucemia. Three patients with chronic myelogenous leucemia who had undergone previous radiation therapy and 4 who had

not had previous radiation therapy, 4 patients with subacute and acute myelogenous leucemia, 2 patients with chronic lymphatic leucemia who had not had previous irradiation and 2 who had had previous irradiation, and 2 patients with acute lymphatic leucemia, were treated. In this same series, 1 patient with polycythemia vera and 1 with sympatheticoblastoma also were treated.

The final evaluation of radiosodium therapy cannot be obtained from the limited number of cases in this series. Radiosodium, however, by mouth, in a suitable quantity and taken at suitable intervals, is effective in reducing symptoms of chronic myelogenous leucemia, chronic lymphatic leucemia, and polycythemia vera. The rate of response of each treatment appears to be intermediate between that of roentgen therapy and treatment with radiophosphorus. The contraindications are similar to those for other forms of radiation therapy. The response to radiosodium therapy is not good when the disease is acute, the radioresistance of the abnormal cells is high, and the hemopoietic system is already damaged. FRANK L. HUSSEY, M.D.

**The Treatment of Keloids at Radiumhemmet, 1921-1941.** FOLKE JACOBSSON. *Acta radiol.*, Stockh., 1948, 29: 251.

Keloids are benign proliferative fibrous tissue overgrowths. According to current opinion they are not regarded as tumors. However, the growth is often very tumorlike. Radium or roentgen ray therapy is the method of choice in the treatment of keloids. At Radiumhemmet 625 patients with keloids have been treated during 1921 to 1941. In 563 cases the keloid was confined to one part of the body. In 62 patients keloids were distributed on two or more parts of the body. There was a preponderance of women. In 112 cases the keloid had earlier been surgically excised one or more times with subsequent recurrence. Five hundred and forty-nine patients were treated with radium, 124 with radium and roentgen, and 25 exclusively with roentgen. The keloid was excised in 27 cases, and then within 10 days the scar was prophylactically irradiated.

In the use of radium, clinical experience has shown that conformity between dosage and skin reaction will be found if the dose has been calculated in accordance with the average of the intensity at a central surface point and at each successive point down to the depth of 1 cm. The dosage now is always calculated as average dose in 1 cm. tissue layer. According to Strandquist this dose is approximately the same as the dose at a depth of 3 mm. under the surface. The unit of radiation intensity chosen is 5 units per hour, having a value of 7.5 roentgens per hour, equivalent to 1 millicurie. The dosage since 1936 has varied between 600 and 1,200 roentgens, usually between 850 and 1,000 roentgens. As an example of the treatment time, it may be mentioned that 900 roentgens are delivered in 2 hours by an applicator containing 10 needles (100 mgm. radium) arranged in one row. Roentgen treatments were given to thick and large keloids not suitable for radium treatment. Sometimes single, but usually divided doses were given. The total doses have been more than 1,000 roentgens (with backscatter) in 21 cases (in 10, more than 1,500 roentgens) and in 22 only one series of treatments was given. Care should be taken in keloids caused by burns. After total doses of more than 1,000 roentgens the skin seems to be easily damaged. The best results seem to be achieved if the keloid is of less than a year's duration. Total regression of keloid was obtained in 73.6 per cent, considerable in 14.4 per cent, evident in 9 per cent, slight regression in 1.9 per cent, and an unsatisfactory effect in 1.1 per cent. FRANK L. HUSSEY, M.D.

# MISCELLANEOUS

## CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Protein Deficiency.** JOHN D. STEWART, HARRY W. HALE, JR., and SIDNEY M. SCHAER. *J. Am. M. Ass.*, 1948, 136: 1017.

The present article is concerned with some of the practical aspects of protein nutrition in the surgical patient, who may constitute a difficult problem because of his inability to eat due to various causes. Intravenous injection of whole blood, plasma, serum, and various prepared mixtures may be the only feasible method of supplying protein in quantity.

The requirements to be met by the solution of amino acids to be used intravenously are: (1) the aqueous solution must be stable and contain a suitable concentration of the essential amino acids; (2) it must produce only minimal changes in the acid base and water balance; (3) it must be nontoxic, nonallergenic, sterilizable, readily available, and inexpensive. The authors utilized a sterilized, aqueous, nonpyrogenic, 5 per cent solution of an enzymic hydrolysate of purified casein and pork pancreas to which dextrose had been added in 5 per cent concentration. The hydrogen ion concentration was adjusted to a value of 6.5. A liter of the solution supplies 50 gm. of amino acids and 50 gm. of dextrose. It is given intravenously once or twice a day in no less than 3 hours per injection.

A variety of conditions in many patients (as much as 90 liters were given to a single individual over a period of 3 months) were treated with the mixture. The incidence of untoward reactions was about 6.5 per cent, the most severe of which seemed to be nausea and vomiting. A point of importance for the severely dehydrated, acidotic patient is the occurrence of a definite lowering of the carbon dioxide combining power of the plasma after its administration in quantity. In a considerable experience the authors have found nothing to contraindicate casein hydrolysate therapy in the presence of grave hepatic disease. Charts are presented to substantiate this statement. The need for other essential dietary constituents such as calories, vitamins, and minerals, among others, must be kept in mind.

For patients with lesions of the upper gastrointestinal tract, intrajejunal feeding is recommended. A jejunostomy, by a modified Witzel technique, made from 18 to 24 inches beyond the ligament of Treitz, under local anesthesia, and with a 16F catheter, was done by the authors. A satisfactory mixture for jejunal feeding must meet the following requirements: (1) the mixture should be complete with adequate amounts of the elements of the normal diet; (2) it should be fluid enough to drip by gravity through a small catheter; (3) it should be neutral in reaction and contain enough colloid to protect the intestinal mucosa against irritant "salt action"; (4) it should be easily prepared, inexpensive, capable of being varied to meet individual needs, and should keep at least 48 hours under refrigeration; and (5) it should yield a low residue and be easily digested and absorbed. A formula, utilizing water, sucrose, casein, yeast, trypsin, vitamins and minerals, is given in detail as well as the chemical analysis which it yields. This mixture is given each day over a 12 hour period in 3 or 4 ounce injections every half hour. Cramps, nausea, and diarrhea may occur if too much is given at one time. This method has been utilized in the alimentation of patients with a variety of conditions including obstructive jaundice and hepatic damage. A brief discussion follows the paper.

ALLAN D. CALLOW, M.D.

**The Mechanism of Delayed Death following Thermal Trauma.** H. C. BERGMAN, H. E. KRUGER, and MYRON PRINZMETAL. *J. Lab. Clin. M.*, 1948, 33: 506.

The authors performed experiments on mice and rats to determine the mechanism of delayed death following thermal trauma.

Previous observations have shown that burn shock was accompanied by a reduction in the circulating blood volume as represented by the bleeding volume, and that two major factors were implicated in this reduction: (1) local fluid loss, and (2) atony of the vessels comprising the capillary bed of the visceral organs.

The bleeding volume was ascertained by removing the heart and mopping up the blood entering the thoracic cavity with weighed cotton pledgets. The presence and degree of capillary atonia were determined by measuring the amount of hemoglobin retained in the liver. The techniques and methods employed are described in detail.

Observations showed that a number of animals died at various time intervals; 300 mice scalded to the head in water at 60° C. for 7 seconds, and 80 rats scalded to the head in water at 65° C. for 10 seconds died from the second day to more than a month later. This investigation was undertaken primarily to determine the bleeding volume and the degree of capillary atony in surviving animals in an attempt to elucidate the mechanism of delayed death after thermal trauma. The experimental results are recorded in a series of graphs. The observations were begun 2 hours after the burn and continued for 37 days.

In mice, capillary atony and a decreased blood volume were demonstrated during the period in which the symptoms of shock were present. Upon the subsidence of these symptoms (generally within 24 hours) the blood volume was restored to its normal value, the capillary atonia disappeared, and there was no further reduction in blood volume or reappearance of visceral congestion throughout the period of observation.

In experiments on rats, after similar thermal trauma, the bleeding volume showed a small but insignificant increase above normal 27 days after the burn. The authors concluded that delayed death after the type of thermal injury employed is not due to persistent or recurrent shock.

JOHN H. MOHARDT, M.D.

**The Pathogenesis of Diastolic Hypertension.** PETER HEINBECKER. *Surgery*, 1948, 23: 618.

A concept of the pathogenesis of diastolic hypertension which has evolved from an understanding of kidney homeostasis and from studies of patients with Cushing's syndrome is presented. There is an extensive review of experimental evidence, chiefly in the dog, which is pertinent to the problem. Denervation of the neural hypophysis in the dog results in a preponderance and overaction of eosinophile cells in the glandular hypophysis. With marked depression of the secretion of the neural hypophysis a normal cardiac output is maintained and a moderate elevation of the mean arterial pressure develops. These changes also occur when the nervous pathways from the thalamus and subthalamus to the paraventricular and supraoptic nuclei are interrupted, when asphyxia in one adrenal gland is produced by ligation of a portion of its arterial supply, when a diminution in the amount of effective renal tubular tissue is produced by removal of one kidney with the wrapping of the remaining kidney in silk, when mulberrylike ovaries are produced by prolonged administration of thiouracil, and when pregnancy occurs. Since several of these associated conditions result in diastolic hypertension, their common factor of eosinophile overaction is considered to be significant as a causative factor in the development of hypertension.

These eosinophile cells are trophic to the adrenal gland, renal tubules, and to the interstitial tissue of the gonads. Loss or depression of the secretion of the neural hypophysis results in sensitization of the blood vessels to epinephrine, desoxycorticosterone, and to renin. Under certain conditions of depression of the neural hypophysis there is increased output of the last two of these hormones, the blood vessels are sensitized, and hypertension results.

In certain cases of Cushing's syndrome an overaction of the eosinophile cells may result. The effects of hypertension and arteriosclerosis, invariably produced, are considered to result from a narrowing of the extrarenal blood vessels and of the efferent glomerular arterioles. Renin is released as a result of the latter action. It is to the combined action of these hormones in persons whose neural hypophysis is depressed and whose blood vessels are, therefore, sensitized to the constrictive action of these hormones that hypertension is attributed. There may be a constitutional susceptibility in addition.

The development of arteriosclerosis may be traced to the overaction of the eosinophile cell-adrenocortical hormone syndrome which results in the increased formation and storage of neutral fat and cholesterol.

The reaction of the body to any inadequacy in renal tubular function is regarded as resulting in hypertension. Renin is regarded as the substance released by the kidney tubules, which not only constricts vessels outside of the kidney directly, but also stimulates the eosinophile cells and thereby increases the cardiac output and renal tubular function. In combination with the desoxycorticosterone fraction of the adrenocortical hormone it leads to extrarenal vascular constriction.

The depression of the neural hypophysis in persons with essential hypertension is regarded first as functional because of nervous influences, particularly from the frontal lobes; later, in the malignant phase, it may be organic as well because the increased intraventricular pressure acts on cells of the supraoptic and paraventricular nuclei.

Constitutional susceptibility of the nervous system to the depression of the hypothalamic nuclei and of the blood vessels to the constricting action of the hormones responsible for the extrarenal vasoconstriction is postulated for essential hypertension.

Inactivation of the secretion of the neural hypophysis by progesterone is regarded as resulting in the eosinophile cell preponderance in pregnancy. This stimulates the adrenal glands, and in those persons who are emotionally and constitutionally susceptible, it would be expected to result in sufficient constriction of the efferent glomerular arterioles to release renin. As in essential hypertension the combined action of these hormones, together with the action of progesterone on vessels sensitized by depression of the neural hypophysis, is regarded as primarily responsible for the initiation of diastolic hypertension.

The accepted importance of emotional influences in the development of essential hypertension is regarded as support of the concept of its pathogenesis as described by the author. The frequent association of obesity, of premature ageing, of decreased insulin sensitivity, and of increased intracranial pressure, particularly in later stages of essential hypertension, is considered to support the probability of the hypothesis presented. Additional support is interpreted as being derived from the fact that the characteristics of the circulation of essential hypertension are similar to those which exist in the hypertension associated with Cushing's syndrome, in which such a mechanism has been established. In essential hypertension the sympathetic nervous system and epinephrine are believed to produce rapid homeostatic adjustments of the renal circulation, but they are not considered of primary importance in the pathogenesis of such hypertension. The author believes that his concept affords a mechanism for explaining the prevailing earlier and wider incidence of hypertension and arteriosclerosis in response to the stress and strain of modern existence.

The interested reader is advised to read the article in detail for the comprehensive review of the pertinent experimental evidence in support of the author's concept, as well as the interesting diagrams illustrat-

ing interrelationships which may exist between the many factors playing a part in the pathogenesis of hypertension. ALLAN D. CALLOW, M.D.

**The Effects of Shock on the Kidney.** DONALD D. VAN SLYKE. *Ann. Int. M.*, 1948, 28: 701.

Present concepts concerning the effects of shock on the kidneys have developed from the studies of many investigators. During World War II, Bywaters and his collaborators reported on the effects of crush and compression injuries with uremic death in a series of cases following burial or pinning beneath falling debris in air raid casualties.

The author outlines the experimental and clinical studies of importance concerning the effects of shock on the kidneys and contributes the results of new experiments on kidney function and pathology initiated by a decreased volume of the circulating blood.

The type of shock here discussed is the condition caused by hemorrhage, burns, trauma, dehydration, or other injury in which there is an inadequate volume of blood to fill the vascular bed. However, the present discussion is limited to conditions of shock in which the decreased volume of circulating blood is due to blood or plasma loss or from dehydration.

The immediate and late effects of shock on the kidneys, based on available data, permit the following conclusions. The immediate effects of shock on the kidneys are circulatory. Renal blood flow is diminished and with it renal excretory function. The decrease may be so great that complete anuria results. However, if the renal ischemia is not too complete or prolonged, the kidney cells are not irreversibly injured, and restoration of a normal general circulation is followed by recovery and normal renal function within a short time. The initial shutdown of the renal circulation appears to be a part of a defense reaction of the organism to loss of circulating blood volume; the vascular bed is contracted by peripheral constriction so that the diminished volume of available blood will be adequate to supply the vital organs, such as the brain, the function of which must be maintained to avoid immediate death.

If shock is severe and prolonged, restoration of the general circulation and recovery from the circulatory symptoms of shock may not be accompanied by resumption of normal renal excretion. Anuria or oliguria may persist, or urine of low specific gravity may be excreted. This period of complete or partial renal failure may last until fatal uremia develops in a period that may vary from 2 to 20 days, or gradual return of function may occur so that the excretion becomes sufficiently restored to prevent uremia, and ultimately recovery of the kidneys may be complete.

Shock must be severe and prolonged to cause irreversible changes in the kidneys, but if it is too severe it causes death from circulatory failure before the patient has had time to develop uremia. The inability to stop the progress of uremia of severe or prolonged shock was a major concern to surgeons in the late war. Renal failure persisting after shock is due to organic injury initiated during shock by ischemia.

Histologic studies by Bywaters and his colleagues (Lucke, Mallory, and others) have revealed severe damage to the renal tubules, mainly the distal tubules and loops of Henle, with little or no glomerular damage, as a constant finding in postshock uremia. The presence of hemoglobin derivatives which formed in the tubules one or more days after onset of renal failure was also noted; this may contribute to the progress of tubular damage initiated by ischemia. The tubular lesions suggest that the cause of postshock uremia may be not the failure of glomerular filtration but the tubular reabsorption of glomerular filtrate and its excretory constituents.

To diminish the danger of death from postshock uremia, the following procedure is emphasized: (1) cut the duration of shock as short as possible by quick restoration of the blood volume through adequate replacement of the lost blood, with plasma or saline solution; (2) if acidosis is present, either during or after shock, administer adequate amounts of bicarbonate of soda; (3) while the administration of large amounts of fluid may be necessary to obtain normal blood volume and hydration, over-administration is to be avoided both during and after shock as circulatory embarrassment may be caused. The measuring of the specific gravities of blood and plasma, preferably by the copper sulfate method, is of practical assistance in planning and guiding fluid administration; (4) when, after recovery from acute shock, anuria or excretion of urine of low volume and specific gravity persists and the blood urea continues to increase, a diet high in carbohydrates and fat, and low in protein should be prescribed to retard accumulation of catabolic products; and (5) it appears that vividiffusion and peritoneal and gastrointestinal irrigation may overcome the uremia and favor recovery of the renal function. JOHN H. MOHARDT, M.D.

**Hemangioma: an Evaluation of Treatment by Injection and Surgery.** NEAL OWENS and KATHRYN L. STEPHENSON. *Plast. Reconstr. Surg.*, 1948, 3: 109.

Hemangiomas generally pursue a benign course but, if untreated, frequently grow more rapidly than commonly suspected, and thus produce cosmetic deformities. Occasionally, there may be rapid acceleration with destruction of an important anatomic part, such as the eye, nose, ear, lip, cheek, neck; or a large portion of the skin of the scalp, neck, back, and extremity may become involved. Ulceration and secondary sepsis may become the problem. When rapid growth takes place as in the aggressive hypertrophic type, it is fundamental immediately to consider surgical excision in order to avoid further destruction, unless one elects injection therapy. Establishment of a positive diagnosis by biopsy is one excellent reason to elect surgical excision in contrast to injection. Rarely, one may encounter a case which on biopsy may appear benign histologically but which, as subsequent history discloses, is malignant due to metastasis. Occasionally, the growth may become diffuse and involve an entire extremity or establish connection with a large blood vessel and become destruc-

tive or dangerous because of severe hemorrhage. In many instances the apparently discrete areas may be deceptive in that their extension can be remote to the area defined by the slightly raised, red tumor.

The female is affected two to three times as often as the male. Although no acceptable explanation for this higher female incidence has ever been offered, Watson and McCarthy have suggested that "hemangiomas may in some fashion be related to the female sex hormone, and in this connection it is of interest to note that a hemangioma may start or increase rapidly in size with the onset of the menses or at the beginning of pregnancy."

It is generally accepted that hemangiomas are tumors of independently growing blood channels with their origin in embryonic rudiments of mesodermal tissue. The vascular channels, their arrangement, and the amount and character of the surrounding stroma are the most logical basis for classification. Angiomas may develop in capillaries and exhibit a capillary structure. Or, they may be composed of large lacunae, usually with venous connections (rarely arterial), surrounded by very little stroma.

Rarely, there are certain of these tumors that are microscopically similar to the ordinary benign capillary or cavernous hemangioma and yet metastasize. When they involve the internal organs extensively they are the cause of death of the patient and thus are malignant. This group is not well defined. Much confusion has arisen in this regard and there are few authentic cases on record.

For the purpose of clarification the following chart based on Foot's classification is presented.

| | |
|---|---|
| Capillary hemangioma | (minimal supporting stroma) |
| Cavernous hemangioma | |
| Metastasizing hemangioma | (cavernous or capillary) |
| Sclerosing fibrous hemangioma | (periendothelial hyperplasia) |
| Hemangioendothelioma | |
| Angiosarcoma | (aberrant plexiform vessels with complete supporting stroma) |
| Arteriolar hemangioma | |
| Cirsoid hemangioma | |

In the treatment of hemangioma the authors have limited themselves to the use of surgical excision and the injection of sodium morrhuate. In almost all types of hemangioma injection therapy is indicated and surgical excision is to be selected when there is no response to injection or if hemorrhage, malignant degeneration, or cirsoid aneurysm is present. Injection therapy is a particularly important method in those cases in which surgical excision to effect a cure would demand the loss of a part such as a nose, ear, lip, or perhaps the exenteration of an orbit. In these instances a cure resulting from sodium morrhuate injection effects the desired cosmetic results with the advantage of saving the part for function.

If all things are equal and surgical excision with eradication is possible by means of one operation, it frequently is the best procedure to follow in order to expedite therapy inasmuch as eradication of the area by injection therapy could mean frequent trips to the office over a period of months. The decision should not be made without careful consideration of the tumor location, the availability of tissue for repair, ease of surgical excision, and the possibility of complete eradication by one surgical maneuver.

LOUIS T. BYARS, M.D.

**Cancer Mortality in Egypt.** MAHMOUD AHMED AFIFI. *Cancer Res.*, 1948, 7: 537.

The reported cancer mortality rate in Egypt in 1942 was 27.2 per 100,000 inhabitants, or, roughly, a fourth of that in the United States and a seventh of that in England and Wales. This is in marked contrast to the death rate from all causes, which is about three times that of the United States or England and Wales. In this article the author discusses the shortcomings of the information on which the cancer mortality rate is based. Only a third of the population of Egypt lives within the area where deaths are formally registered. Only half of the death certificates filed for this area list a cause of death. In the majority of instances in which a cause of death has been listed there has been no opportunity to ascertain the diagnostic accuracy of the certificate. The author believes that many deaths from cancer may have been listed under some other causes.

Analysis of data for the 12 year period from 1931 through 1942 show that the most frequent site of fatal cancer was the male genital organs, with 1,451 deaths out of the total of 12,606. Malignancy of stomach and duodenum accounted for 1,337 deaths. The next two most common sites of fatal cancer were breast and uterus, with 1,229 and 1,216 deaths respectively for these organs. Although the breakdown of the whole group of cancer deaths by sex, age, race, and religion, as well as by the section of the country from which the death was reported, seems to show very significant differences, the author is inclined to attribute many of these differences to poor reporting and certification of death.

There has apparently been no occupational cancer in Egypt, nor has there been any cancer resulting from radiotherapy. However, there has been a high incidence of cancer in conjunction with bilharziasis, especially that of the bladder. Since this disease affects from 30 to 90 per cent of the population of Egypt, it is difficult to evaluate the causal relationship between it and cancer; indeed, the author doubts whether there is a causal relationship.

BENJAMIN F. LOUNSBURY, M.D.

## DUCTLESS GLANDS

**Interpretation of Estrogenic Therapy of Cancer of the Breast (and Prostatic Gland). The Elective Effect of Estrogens on Mesenchyma, and Its Importance** (Interpretazione della terapia estrogena del cancro della mammella [e della prostata]. Azione elettiva degli estrogeni sul mesenchima, sua importanza e significato.) C. SIRTORI and R. GRATTAROLA. *Tumori*, Milano, 1947, 33: 319.

Histologic studies of cancers of the breast, favorably influenced by estrogenic therapy, did not dem-

onstrate regressive alterations in tumor cells but showed a substitution of connective sclerotic tissue by one rich in blood vessels, fibrillae, and histiocytic formations.

The hard consistency of tumors and their fixations are caused, according to the authors, by the character of the stroma rather than that of the neoplastic cells.

Modifications of the stroma caused by the estrogenic therapy are responsible for the reduction of the size of the tumor, its increased mobility, the ceasing of pains, and recurrence of canalization, such as may be observed in carcinomas of the prostate gland.

Observations on patients and experimental studies revealed to the authors the elective hyperplasiogenic effect of estrogens on the mesenchyma.

The observations were made on 2 young women, 2 women in the menopause, and 2 men. Fibroadenomas and biopsies of the skin were studied in patients who underwent the treatment with estrogens and in control persons.

The stimulation of the mesenchyma by estrogens is more intensive whenever an abnormal activity of the tissues, caused by ulcers or foreign bodies, is present.

The effect of estrogen on cancer of the breast is different in women during active sexual life from that in women in the menopause. In the first group a large number of fibrillae develops and the connective tissue appears soft, while in older women a fibrous, hard stroma much poorer in cells results from estrogenic therapy. JOSEPH K. NARAT, M.D.

**The Neuroendocrine Regulation of the Intestinal Absorption of Glucides** (La régulation neuro-endocrinienne de l'absorption intestinale des glucides). ANDRÉ SOULAIRAC. *Ann endocr.*, Par., 1947, 8: 377.

The author has completed an experimental study in the rat on the action of the endocrine glands and certain nervous mechanisms in the regulation of the intestinal absorption of glucose and glucides.

Experimental evidence would suggest that such absorption is controlled by hormonal activity of the islets of Langerhans, the thyroid, the adrenal, and the hypophysis. From the work presented it would seem that the action of these hormones is in turn dependent upon a hypophyseal-hypothalamic synergistic regulatory center.

This concept bears further investigation and may cast much light on certain nutritional problems and diabetic states. EDWARD W. GIBBS, M.D.